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CINE-FILM PROJECTION



CINE-FILM PROJECTION

*A practical manual for users of all types
of 16-mm. and narrow gauge film projectors*

by

CECIL A. HILL
F.S.C., M.B.K.S.



L O N D O N
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The author is also grateful to his many friends for their prompt assistance and encouragement.

To

WILLIAM FRIESE-GREENE

The Inventor of Kinematography

His Genius Bestowed upon Humanity

The Boon of Commercial Cinematography

Of which he was the First Inventor and Patentee

Preface to the Revised Edition

THE success of the first edition, coupled with the extraordinary and rapid developments in every phase of narrow-gauge projection, has made another printing inevitable. The reader will find that almost all theory has been ruthlessly discarded, the whole now being designed to cater for the practical minded. New features include practical instruction on Dual Projection, Arc Projection, Sound Conversions and Sound Test-films, Methods of Testing Screen Brightness, etc., and a great deal of similar information which is specially designed and planned to help the reader with no previous knowledge of the subject. The author and publishers fully realise that a certain amount of information has been omitted. This is because it was necessary to prevent digressions into the realm of pure science, and to provide only that information required by the reader who wishes to become proficient in projection in the shortest possible time. There are no superfluities—no mathematical calculations to be made before the reader knows what the author means to convey. And where the information *could* confuse some readers, there you will find an illustration.

A notable omission is the List of Manufacturers and Film Libraries. But the truth of the matter is that we simply couldn't bring this list up-to-date without usurping the function of the year-books. Such a list today would take more than 200 pages and require continuous revision. So we have listed the year-books instead!

The list of Acknowledgements has also been enlarged, for it was found necessary to apply for information to a large number of equipment manufacturers so that both revision and additions could be made in the text. A special acknowledgement, however, is now paid to Mr. R. H. Bomback for his valuable assistance in checking the manuscript and making a number of worthwhile contributions.

Contents

Chapter	Page
1 A GENERAL EXPLANATION	15
<i>Some Basic Facts—Persistence of Vision—The Meaning of Sub-standard—Choosing the Right Equipment.</i>	
2 PROJECTOR SYSTEMS	24
<i>The Film Track—The Optical Systems—The Lamp and Reflector—Projector Lens—The Shutter—Gate and Aperture—Framing—The Intermittent Movement—Cooling Systems—The Still-picture Device and Heat Filter—The Feed and Take-up—The Motor—Reverse—Projector Speed—The Pilot Lamp—The Controls.</i>	
3 THE SOUND PROJECTOR	38
<i>Sound Films—Scanning—The Photo-electric Cell—Exciter Lamps—The Smoothing System, Damping—The Amplifier—Valves—The Loudspeaker—Sound Conversions—Synchronising Gramophone Records.</i>	
4 ADDITIONAL EQUIPMENT	48
<i>Resistances—Transformers—Electrical Connections—Non-syncs—Microphones and Other Sound Additions—Using Microphones—Rewinders—Splicers—Cables and Connectors—Equipment for D.C.—Spools and Containers—Projector Stands.</i>	
5 FILMS AND FILM CARE	60
<i>Cleaning Films—Dangers of Mutilation—Definitions—Protecting Films—Film Cement—Splicers—Preventing Damage—Splicing a Film—Examining the Programme—Loop and Cycle Films—Testing for Damage Caused to Films—Test-Films for Lens Definition—Test-Films for Picture Steadiness—The Buzz Track—Constant Frequency Test-Films—The Snake Track—Sound and Picture Test-Films—Repairing Damaged Films.</i>	

- 6 SCREENS 75
The White Screen—The Silver Screen—Beaded Screens—Translucent Screens—The Perforated Screen—The Screen to Choose—Testing Screen Brightness.
- 7 EXHIBITING AND LAYOUT 90
Setting up the Equipment—The Mobile Operator—Rear Projection—Operators' Routine—The Performance—Examining the Screened Picture—Dual Projection—Change-overs on Projectors having One Switch only—Making Change-over Cues—Change-over Units—Monitor Speakers—Continuous Projection—Arc Projection—Coloured Films and Slides—At the End of the Show.
- 8 SERVICING EQUIPMENT 115
Lubrication—Cleaning the Projector—Seven Commandments—The Lens—Motor Care—Wire Belts—Screws and Rollers—Sprockets—The Daily Clean—The Weekly Clean—Dispatching Equipment by Rail.
- 9 FAULTS AND FAULT FINDING 124
Correcting Faults During Projection—Loss of Bottom Loop—Projector will not Start—Projector Running Slow—Speed Varies—Loss of Top Loop—Projector Lamp Fails—No Picture—Poorly Lit Picture—Picture Lacks Definition—Jumpy Picture—Flicker—Irregular Take-up—Take-up Failure—Shutter 'Ghost'—Feed-spool Tensioning Weak—Tightening of Feed-spool Braking-Device—No Sound—Low Volume—Sound Poor and Distorted.
- 10 WITHIN THE LAW 133
Entertainments Tax—The Quota Act—Home Office Regulations—The Performing Rights Society—Sunday Shows—Other Restrictions.

Chapter	Page
II FOR THE EDUCATIONIST	139
<i>Production—The Teacher's Needs—Using the Tools.</i>	
12 SOME MODERN EQUIPMENT	147
<i>The Tungsten Arc—Magnetic Recorders and Reproducers—A Transportable Proscenium—The Drum Loop Absorber—A Draw Curtain Unit—The Amprosound Premier-20—The Ampro Imperial—Bell and Howell-Gaumont Model 601—B.T.H. Model 301—The Carpenter—The Debrie D-16—The 8-mm. Dekko Model 118—The 8-mm. Kodascope Eight-45—The 9.5-mm. Pathe Ace Projector—R.C.A. Model PG-201—The Victor Animatophone.</i>	

APPENDIX

PUBLICATIONS	171
SELECTIONS FROM THE LIST OF B.F.I.	
PUBLICATIONS	172
YEAR BOOKS	172
THE BRITISH FILM INSTITUTE	172
THE BRITISH KINEMATOGRAPH SOCIETY	173
THE ROYAL PHOTOGRAPHIC SOCIETY	174
BRITISH STANDARDS INSTITUTION	174
PRACTICAL DEFINITIONS	175
INDEX	183



Introduction

ALTHOUGH primarily intended to assist the user of modern 16-mm. sound projection equipment, the simply-written contents of this book are so designed that users of all gauges of sub-standard and 16-mm. cine and "still" projectors will also find it of value.

The amount of time and care necessary to learn the correct methods for operating and servicing a 16-mm. sound projector, will, however, be considerably greater than with the smaller and relatively cheaper 8-mm. and 9.5-mm. models. The modern 16-mm. projector is expensive, and the post-war models are built to "professional specifications." This means, briefly, that the user must now be taught a greater number of technicalities than was previously necessary, and the necessity for this injunction is at once painfully obvious when we consider that the cost of certain repairs to a 16-mm. projector may far exceed the purchasing price of a 9.5-mm projector. But are the instructions in this book so frightfully complicated? Not in the least—they are designed to inform the novice, and to guide the professional.

What then, you may ask, is the actual difference between these projectors of different gauge? In principle, there is no difference. All projectors have an optical system, an intermittent movement, feed and take-up systems, shutters, sprocket-wheels, guide-rollers, etc., and the specific functions of these parts are the same irrespective of the size of the machine. The real difference is in the size, position, speed and relative efficiency of the parts. For instance, in a 9.5-mm. projector the teeth are positioned in a single row around the middle of the sprocket-wheels, whilst in a 16-mm. silent machine the teeth are found on either edge of the wheels, and the latter may be larger and revolve at a different rate.

The intermittent movements may also vary, and the stop-and-start movement of the film may be accomplished by one of a number of distinctly different types of mechanism. But no matter what the mechanism employed, they all function to

produce the same result—the pulling down of the film, one frame at a time, in front of the aperture. But do not let these differences worry you. Master the theory of projection and you will master all projectors. You need then be shown only the individual lacing and other characteristics of a new machine to be able to use it proficiently in the shortest possible time. What does it matter how big the sprocket-wheels or how fast the shutter? Learn the functions of these parts and you will know how to deal with them, for by knowing the functions and the results produced by them, you will automatically know the most probable cause of a fault in projection should one develop.

Besides explaining the workings and the “innards” of your projector and the essentials of projection technique, the book also discusses and enlarges upon the instructions issued by the makers of the various kinds of equipment. But on no account is the book meant to take the place of those instructions; for the reader may possibly find a statement at variance with the design or operation of his own projector, in spite of the fact that great pains have been taken to make the whole applicable to every known cine projector used or about to be used in Britain, and including also those of foreign design and manufacture.

C. A. HILL

1

A General Explanation

Some Basic Facts

THE act (or art) of making pictures by means of film chemically treated is known as photography, and the apparatus employed is called a camera. Cameras may be either "still" or "motion picture" cameras, and the art of using the latter is known as cinematography. Thus we have photographers and cinematographers.

A photographer uses a (still) camera and takes still pictures—one at a time. A cinematographer uses a motion-picture camera (or cine camera), and by using a long reel of film, takes a number of pictures every second.

Any apparatus used to project a picture onto a screen is known as a projector. A "still" projector, such as the magic lantern and the film-strip projector, will project pictures one at a time and for any length of time. A motion-picture projector, using the large sequence of pictures originally made by the cinematographer, projects onto the screen at the rate of 16 or perhaps 24 pictures per second. Projection, which describes the art of using the projector, is the main subject of this book.

When you use the machine yourself, you are an operator, but if it is your profession you may be called a projectionist. The cinema owner, or manager, is known as a film exhibitor, which describes a person skilled in the arts of both projection and showmanship. Exhibitors who manage mobile cinemas, such as those which tour the village halls, are known as road-showmen.

Companies which make motion pictures are known either as producers or as production companies. Those which "rent" their films to the cinemas are called renters, but they may also rent their films to other companies whose chief activity is the distribution of films. The distributors, in turn, may also send the films to many other centres throughout the country, and

these centres are now generally known as film libraries.

Thus we have producers, renters and distributors, libraries, exhibitors and projectionists. As you are probably one of the last named, with the task of actually presenting the films which all the other people have handled, you may consider that your job is the most important of all. And whether you intend to exhibit hired films at home or to the public, do spare a thought for all the hundreds of people who have made the show possible. And look after both the film and the equipment which will use the film.

Persistence of Vision

ALL MOVING PICTURES owe their existence to an interesting and natural phenomenon known as the "persistence of vision," and, as the majority of readers know, the whole of the film industry is actually founded on what is really an illusion. Illusion, because in actual fact there is no such thing as a moving picture in cinematography.

What the cinema patron sees is a series of "stills" flashing onto the screen at the rate of twenty-four per second, but as the retina of the eye temporarily holds each flash of light he is not aware that there is any interruption in the apparently continuous light-beam directed at the screen. Each flash is of equal intensity, and as the impression on the retina fades, the succeeding flashes obliterate the fading impressions and yet continuously revive them. In other words, the eye holds each flash (and each "still" picture) until the next one cancels it out, and as each picture shows a development of movement in relation to the next, the observer is therefore under the impression that the picture actually moves.

The "persistence of vision" then, prevents us from seeing any separation between the rapid succession of "stills", and it is thus that we are able to enjoy the illusion of moving pictures.

The Meaning of Sub-Standard

The width of the cine film is usually measured in millimeters, and is often printed in an abbreviated form such as 16-mm. The length of a film is usually given in feet, with the exception, of course, to be found in those countries using the metric system.

The actual width of the films used in most cinemas is 35-mm., and the films and projectors using this size of film are known

as Standard. Films and projectors below this size are known as Sub-standard, such as 8-mm., 9.5-mm., 16-mm., 17.5-mm., etc. This is the generally accepted meaning of the term "sub-standard", but for two very important reasons it is not quite correct to include 16-mm. within this category. The first and obvious reason is because both 16-mm. and 35-mm. were made Standard by the Society of Motion Picture Engineers many years ago—a fact recorded in the 1935 edition of "Richardson's Bluebook of Projection."

The second reason is because manufacturers have long been engaged in the betterment of the 16-mm. machines alone, and in many cases during the war, ceased production of the other sub-standard machines altogether. This state of affairs was brought about by the enormous demand for training films and entertainment of the Services, and later by the immediate requirements of our schools.

The manufacturers are thus supplying a projector which meets the demand of a million new customers—a projector, which though light and portable, must be capable of giving a slick professional show to audiences numbering up to 1,000 people, and in some cases, for audiences of double that number.

Many of these projectors now cost from £200 to £300 and are described as being "truly professional models" by the makers; a phrase which is perfectly true for the majority of new machines, but which obviously cannot be reconciled with the term "sub-standard." But what of the cheap "toys" which were sold in the shops prior to the war? Some were hand-cranked models, and in more ways than one, were definitely sub-standard. It is obvious, therefore, and perhaps a necessity, to find a new name for the modern 16-mm. sound-on-film projector, for there is nothing sub-standard about its design or performance.

And we must not forget the new cinemas now being fitted with 16-mm. projection equipment, especially those to be found in small communities and in countries where rebuilding after the war is not economically possible. In Britain, for instance, the number of 16-mm. statics has grown from half a dozen to nearly 200 since the end of the war, and a large number of others are now being planned.

Facts and figures do not always present a clear indication of what is happening within a certain industry, but those which

follow speak for themselves and need no explaining: A report from UNESCO stated that the number of 16-mm. projectors required for China amount to 50,000, and for India 30,000. For every three manufacturers producing 16-mm. projectors before the war there are now nearly twenty. 16-mm. films are now being shown in Tibet, Central Africa, Ust Yurt, Alaska, the East Indies, the Outer Hebrides, the Isle of Sark, and at Chinwangtao. They are also being shown to the natives of those countries now being invaded by bulldozers, growers of groundnuts, and diggers of thorium. They are being shown, in fact, wherever and whenever the spirit of enterprise moves forward. The present growth of 16-mm. is, indeed, the biggest thing which has happened since the introduction of "talkies." We hope that the reader who is commercially-minded has already picked himself a place on the ground floor, and that the teacher will not be slow to use the new machines now becoming available.

Choosing the Right Equipment

The short cut to knowledge of any subject is by asking questions, and in this section the author provides the answers to what may be considered the "representative questions" asked by the average newcomer to cine projection, and which may serve to illustrate succeeding subjects.

Q. I wish to purchase a small projector for use at home—chiefly to show the films I have taken with my new 16-mm. cine camera. I should also like to use it for showing entertainment films, though I'm not sure whether such films are available for the private user. What kind of projector should I ask for?

A. The projector you need will be one specially constructed for 16-mm. films, and all you have to do is merely to ask for a 16-mm. machine, and, one that will satisfy your needs. As you wish to show entertainment films one of your projector-needs will be spool-arms capable of carrying 1,600 feet of film, as the majority of library entertainment films are spooled-up in 1,600 feet lengths. You will have no difficulty in getting the films, and you may join one or more of the 300 odd film libraries now to be found in Britain. The cost of hire varies from 2/6d. to 17/6d. per reel (400 feet) per day.

Q. Assuming that I am about to make a choice from a number

of projectors lined up for my inspection, what should I look for and what should I guard against?

A. The first thing to do is to find out your exact requirements, such as the average size of your audience, the size of the hall or room to be used, the size of the screen, and the length of throw. Assuming that your audience numbers about 400, you should use a 6' or 8' screen, a projector having a lamp of about 500-watts, and a lens of about 2" focal length (16-mm.). When you have worked all this out you can then go along and look at the machines. Some of the things to look for are as follows:—

That the projector lamp has a slightly higher wattage than your requirements demand.

That the projector may be used on the electricity supplied in your district. (Check the voltage and whether it is A.C. or D.C.)

That you choose, if possible, the projector having the quietest-running mechanism.

That the spool arms are sufficiently long for the spools you will use (400', 800', 1,600', etc.). Do not choose a projector with arms for 400' spools if you have to use it for a number of 1,600' films.

That the standard projection lens supplied with the projector is of the right focal length. If necessary, ask for the lens to be changed before you make the purchase.

That it has the necessary attachments or is adaptable to your secondary requirements, such as the showing of single frames, or having inputs for mike or gram.

That it is fully demonstrated, and sold with a guarantee of its worthiness.

(There are many other points to watch—points which will become clear to the reader in succeeding chapters. But important is the admonition—never buy a secondhand machine unless accompanied by an expert.)

Q. I have a silent projector which I want converted to sound. Can you tell me where I can find someone to take on the job?

A. Yes, but before I tell you I must ask whether your machine is worth converting or not. There are only a few pre-war models worth the expense, and unless your projector is a really good sturdy one you are advised to forget about it. The conversion usually consists of a sound-head, amplifier, longer spool-arms, projector case (blimp) with carrying handles, loud-speaker fitted

within a baffle case, and a number of other things, but all of which will make the cost of the conversion very similar to the initial cost of your projector. If you originally paid about £60 for the projector you can expect to pay another £60 for the pleasure of hearing it produce sound. Advertisements in the cine trade press will give you the names and addresses of the firms specialising in this work.

Q. I have recently taken delivery of a 16 mm. projector fitted with a 2" lens, which I have to instal in a building 45 feet long. What size screen do I require?

A. You will need a screen exactly 8' 5" wide for a throw of 45 feet, but having regard to the fact that setting-up the projector will actually cause your lens to be four or five feet from the back wall you should reckon on a throw of about 40' instead of 45'. The width of the screen should therefore be approximately 7' 6". (See table on p. 79).

Q. Where can I exchange my 17.5-mm. projector for one using the 16-mm. gauge?

A. Through a cine dealer—look for one who advertises cine sales and exchange. Very few people will want to make such an exchange with you, however, and I suggest that you have the gauge converted. This will cost an amount perhaps equal to what you would probably lose were you to effect the exchange you contemplate!

Q. I find it necessary to purchase a 3" lens for my 16-mm. projector. Is there any particular make you would recommend?

A. Yes, the one recommended by the manufacturer of your projector. When giving your order state the make and model of the projector, i.e., G.B. model H.16. The fact that you require a 3" lens indicates that it is to be used for a fairly large audience, and I advise you to ask for a "bloomed" one. This means that the lens has been surface-treated to ensure added brilliance and better definition.

Q. I have just bought a small projector for use at home. It has an A.C./D.C. motor and I thought this would be all right to use on the D.C. mains in my district, but now I find that the motor is rated for 110 volts only and that I shall have to get a transformer. Can you tell me where I can get one and exactly what I should ask for?

A. You appear to be asking for trouble. A transformer must

not be used on D.C. What you need is a resistance. Ask your local cine dealers to supply you with one to match your projector.

Q. Everybody tells me that I must not use sound films on my silent 16-mm. projector, but as I particularly wish to see some of these films I should be grateful if you could tell me a way out of the difficulty.

A. Sound-film has only one row of perforations, and must therefore be used on a projector with sprocket-wheels having only one row of teeth. The only way out of your difficulty is by replacing all the sprocket-wheels with single-row ones, and by changing the claw movement, either completely or by alteration, so that the claw(s) properly engage the perforations. When the job is finished use a test film and then examine it for scratches and strained perforations, etc., and not until you are absolutely sure that the machine is working satisfactorily should you apply for library films. But the job is really one for an engineer.

Q. We have just finished making the balcony into a first class operating box, and the next thing is to find the right kind of screen. We would like to get the best possible beaded screen obtainable—expense is no object, of course, and we'd like you to fix it up for us. Will you pick out a good beaded screen for us?

A. Definitely no. But I will help you to get a white or silver one. A beaded screen always reflects the light back towards the source. In your case this would be towards the balcony, and only the operator would see the picture at its best. I must see the hall first before advising you further. (See chapter on Screens.)

Q. All my apparatus, including the projector, is for operating on A.C. mains only. Can you tell me what I have to get for working it on D.C.?

A. You need a rotary converter, but do not forget to obtain one capable of handling the total wattage of all your equipment.

Q. Is it possible to buy a 9.5-mm. sound projector?

A. Yes, the Pathescope "Pax" is a good example of one. It has a 400-watt lamp, capacity for 900-foot spools, and ample sound output for use in a small hall.

Q. Where can I obtain a complete description of new equipment as it becomes available?

A. Reviews of all new projectors and accessories are given

from time to time in the Film User, Amateur Cine World, Sub-standard Film and the Mini-Cinema. Test reports are also given, and the reports are often quite frank!

Q. Will the recent introduction of magnetic sound mean that my projector will shortly become obsolete?

A. No, photographic sound-tracks will remain standard for many years to come. But your next projector may have a magnetic sound-head—if you prefer it.

Q. I have written to a number of film libraries because I wish to hire from each one or two films, but three have asked me for a £5 deposit and a couple want £2. It seems I am supposed to fork out nearly £20 in deposits before I can hire the films I want. Is there any way of getting round this?

A. Yes, ask your usual film library to book the others for you, or approach one of the booking agencies. You will find the agencies listed in the Year Books.

Q. Where can I get a home movie for about a fiver? Or are they all as expensive as cars . . . ?

A. A number of new 9.5-mm. silent projectors are now available for home use, and their average price is just what you can afford to pay—£5. Motorised attachments can also be had, but do not overlook the intense pleasure experienced by kiddies when making "it work" themselves; which means, of course, cranking by hand. Films can be bought or hired, and the screen can be a sheet of paper. You can make your own cinema and have it working by this evening if you wish to present Junior with a gift he'll love.

Q. What is the difference between dual projection and a dual projector?

A. Dual projection means using two projectors alternately in order to give a continuous performance. A dual projector is one on which films of two different gauges may be used. Model or Type "916", for instance, usually denotes that the projector can use both 9.5-mm. and 16-mm. films.

. . . And so the questions could continue. Questions which show, on summing up, a general desire for the right equipment, for the best equipment, or for an improvement in existing equipment. The inquirers also display a certain amount of caution, as the actual questions prove. But caution is a quality we recommend, and in a projectionist, may be regarded as a virtue rather

than a vice. The cautious man always asks an expert if he is not sure about something. And by asking he saves his equipment from possible damage. He also saves his pocket, time and temper, and perhaps his life as well!

2

Projector Systems

The Film Track

THE route taken by the film as it travels through the projector from spool to spool is known as the film track. Fig. 1 shows the film track of a typical silent projector. You will notice that the film is drawn from the feed-spool by the feed sprocket-wheel, after which a loop is made in the film before it passes through the gate where it will be moved in a series of jerks by the intermittent mechanism. Below the gate is another loop, after which the film is again pulled at an even speed by the first take-up sprocket-wheel. The film then continues, perhaps via one or more guide rollers, onto the take-up spool.

In a sound projector, however, the film would be taken through the sound-head after leaving the gate, and then on to the take-up spool. The sound-head is the place where the business of scanning the photographic sound-track takes place. (See Fig. 6).

The film track, then, consists of the picture-gate, sound-head, two or more sprocket-wheels and a number of guide rollers, the whole forming the "operating side" of the projector. The opposite side is known as the non-operating side (not right or left) and the front of the projector is the end in which you will find the projection lens. And the back of the projector is the "rear". Remember these apparently naive instructions and you won't get lost . . .

The Optical Systems

Every projector consists of a number of systems, which may be examined separately in order to get a clear idea of their respective functions. Most important, of course, is the optical sys-

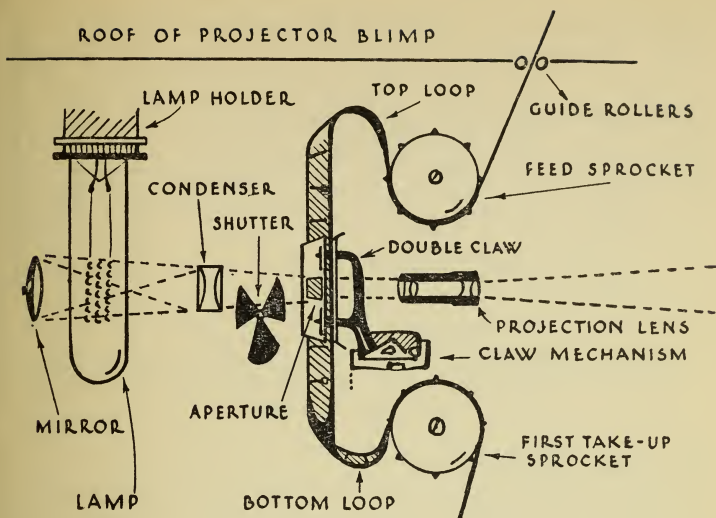


Fig. 1

tem, usually consisting of a lamp, reflector, and a number of lenses (Fig. 1). In a sound projector there are two such systems, for light is also needed for reproducing sound. These are usually referred to as the **FILM OPTICAL SYSTEM** and the **SOUND OPTICAL SYSTEM**.

The condensing system is part of the optical system, and merely consists of one or more lenses so arranged that they collect the light from the source and direct the "condensed" light towards the projection lens. In the Diascope (magic lantern) we see this system in its simplest form. It consists of a reflector, a lamp, one or two condensers, a slide carrier and the projection lens (Fig. 2).

In many projectors the condenser lens nearest the lamp may be loose in its setting, or mount, and this must not be tightened because the heat from the lamp causes the metal to expand and thus exert pressure. If the condenser was screwed in tight it would very soon crack after switching on the lamp. Other lenses should not be loose, but neither should they be screwed in so tight that they cannot be removed without force.

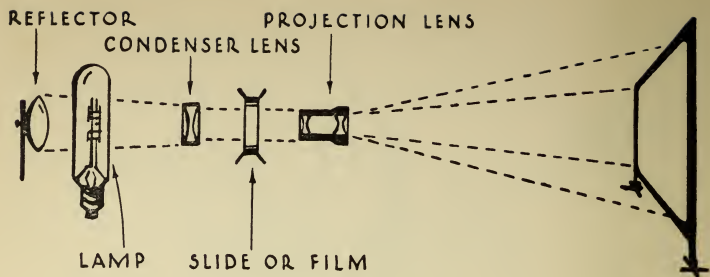


Fig. 2

DIASCOPIC PROJECTION

Diascopic simply means "direct" projection, such as in an optical lantern. The light is projected in a straight line from the lamp to the screen.

The Lamp and Reflector

Projection light may be provided either by the carbon arc or by means of a special filament lamp. The former is chiefly used in 35-mm. cinemas and the latter in 16-mm. and other narrow-gauge projectors. The carbon arc is considered to be the best light for projection, in that its light is of high intensity and fairly concentrated. It is not, however, a very safe or practical form of lighting for amateur use. Manufacturers have therefore devoted considerable research to the betterment of the filament lamp, and the ones in use to-day compare very favourably with the carbon arc.

A number of modern 16-mm. machines are now fitted with a very efficient 1,000-watt lamp, and some have been used in standard cinemas without the patrons being aware of the fact.

These lamps are mostly prefocussed, being automatically aligned and centred for projection when inserted in the projector.

Many projectors have an open top to the lamphouse and where the lamp is inserted in an upward direction it may be advisable to use a lamp fitted with a metal cap or blackened with paint at the end, as this will prevent the upward flow of light from the lamphouse, and which in a small hall may considerably spoil your picture. A possible drawback, however, is that the method sometimes tends to increase the heat within the lamp and thus helps to shorten its life. On the other hand, extra heat means extra light, but without the use of extra current.

The lamp in the average silent projector is usually one of 300 watts, though many are made to take lamps of 500 watts, whilst in sound-machines 750-watt lamps are in general use. Many of these lamps are rated for 115 volts, and a resistance or transformer is now a usual part of the equipment. The lower voltage lamps have three main advantages—less chance of the filaments fusing, stronger wires not likely to sag, and a greater proportion of light to heat.

Considerable care must be taken if the lamp is to last its full rated life, usually 30 to 50 showing hours. Avoid switching it on and off more than is necessary during a show, never turn the projector on its side while the lamp is still hot, and always avoid jerking or jarring the machine.

Behind the lamp is the reflector, and care must be taken to see that this is correctly aligned if of the adjustable type. To do this, switch on the lamp, remove the projection lens and hold a piece of white paper in front of the lens mount—you should then be able to see the shadows of the filaments upon the paper. The reflector will show a second lot of filaments, and their reflection on the paper should be aligned exactly between the rows of the others. If you find the reflections are out of place after changing the lamp then you must adjust the lamp, and not the reflector.

Many of these reflectors are made of glass, and as the lamps sometimes blister before burning out, great care must be taken not to allow a blister to touch the reflector as the latter may easily crack. It is quite in order to use a blistered lamp, but it must be removed before the blister gets too large.

In some cases a blistered lamp may have to be broken before it can be removed from the lamphouse—don't let this happen to you. Always change the lamp as soon as the blister necessitates a change.

Lamps sometimes blacken, and those giving poor light should be changed at once. Never step-up the voltage instead.

When changing a lamp always carry out the operation as quickly as possible, for the metal parts act as a cooling-flange when exposed to the air and soon become too hot to touch. *Never change a lamp without first switching off the electricity supply.*

The Projector Lens

Projector Lenses are made of optically worked glass, and are often "bloomed" with a special surface coating for added brilliancy. Some are quite easy to scratch, and great care should be taken when cleaning them. Focussing is achieved by moving the lens either forwards or backwards, and is accomplished by revolving the lens or by actuating the lens mount by means of a handy screw.

Projector lenses are supplied in various focal lengths of from one to four inches, though it is quite possible to obtain others. The two-inch lens is supplied as standard with most sound projectors, and will fill an 8' 6" screen at an approximate distance of 45 feet; a picture roughly $1/5$ th as wide as the throw.

The Shutter

The shutter consists of one or more blades attached to and revolving round a central axis, and has as its function the interruption of the projection light each time the film is moved in the gate, and also, to provide a succession of light flashes at such a rate as to prevent any flicker in the screened picture.

"Shutter ghost" is the name given to a white blurring on the screen caused by the blades of the shutter requiring adjustment, though in most projectors you will find that only one can be adjusted. This is usually the largest of three, and it should be moved either to the right or left according to whether the blurring is a top or bottom ghost. The degree of movement in adjusting will be very slight, but nevertheless, the operation is somewhat tricky, and you are advised not to attempt any such adjustments unless you are well qualified to do so. The other blades should not be tampered with as they are precision set in order to provide a flickerless picture by means of even alternations in the light for projection. Other shutters have only one blade.

The Gate and Aperture - Framing

The Gate, or Film Channel, is that part of the projector wherein the film is moved by the intermittent mechanism. It includes an adjustable framing device next to the picture aperture, and allows the operator to maintain the correct alignment of the frame on the film with the frame of the aperture, and ac-

compleishes this by the movement of the aperture mask or of the film itself. In the usual device found in 16-mm. projectors the adjusting of the frame slightly moves the picture off the screen, thereby necessitating a corresponding adjustment by the tilting device, and which will lift or lower the projector head.

The gate is usually made to open by moving a hinged section outwards, but in many types the moveable parts are made to separate by the front section of the gate moving forward or swinging open. Highly-polished runners within the gate lightly hold the film in position, and in some cases side rails, delicately spring-loaded, help to keep the film correctly placed. Film gates which cannot be opened for threading are usually called Channels, and in these the film is held in position by side tension only, thereby obviating any possible scratching to the film's surface.

The gate pressure pad (or plate) is often adjustable, but the pressure or spring tension should not exceed a force of 4 ounces. Normal pressure may be slackened if necessary when using new (green) films, but note that in all cases normal pressure means no more than sufficient pressure necessary to maintain the steadiness of the film in the gate, and thus prevent the screened picture from jumping.

The Intermittent Movement

This is the most important part of any projector, for it includes the mechanism necessary for the stop-and-start movement of the film, resulting in the rapid succession of stills.

In principle, it facilitates, by a number of means, the pulling down of each picture or frame of the film, holds it absolutely square and motionless for a fraction of a second, then repeats the movement. When the film is momentarily held in position a flash of light projects the picture on to the screen, the light then being covered by the revolving shutter blade as the next frame is pulled down into position. It is obvious, therefore, that all this film-shifting requires a mechanism which will carry out these movements smoothly and without much noise, and also, which will not in any way damage the film. This last requirement is extremely important, because almost all faulty intermittent movements either damage the film or in some other way spoil projection.

There are four main types of intermittent movement; the claw, wherein one or more claws engage the perforations in the film; the intermittent sprocket, which has a number of stops to each revolution, and the shoe, wherein a curved bar engages a loop of film and pulls it down by means of its rapid up-and-down movement. The fourth type is known as the "decimittent," but is not in general use in Britain.

The most common in cine equipment is the claw movement, but although four out of every five of the post-war models are fitted with this movement, the intermittent sprocket must be considered of equal merit.

In *all* projectors the intermittent movement of the film itself must be isolated from the rest of the film running through the machine at an even rate, and this is usually accomplished by maintaining a loop of film at each end of the gate or film channel. This loop must retain the correct size, as a top-loop too large will cause the film to flap and add to the noise of the machine, whilst a lower-loop the wrong size will put the sound out of synchronisation with the picture. In many projectors the manufacturers have included a mark denoting the exact position or size of the loops.

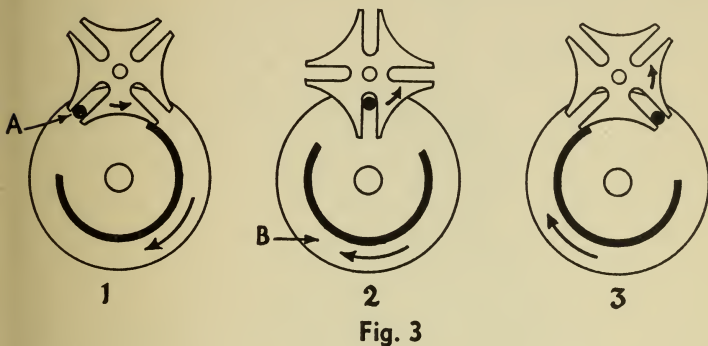
Should the loop be lost during projection the motor must be stopped at once, otherwise the film will be damaged by being pulled between the intermittent and the first take-up sprocket. In some projectors, however, the bottom-loop is formed around a trip switch, which will automatically stop the motor should the loop be lost.

One advantage of the claw mechanism is that it can be more easily serviced than the cross movement, and in this respect you should read your Operators' Instructions for some specific reference to oiling or greasing. But in the absence of such instructions the operator should attend to the servicing of a cross movement at least once in every three months.

If the mechanism of the intermittent-sprocket is sealed within an oil bath, however, it should not be tampered with. Here the operator must ensure that all oil-tight joints are indeed as tight as they should be, and watch, or rather listen, for any signs and indication of wear. An intermittent "beat" in addition to the normal noise made by the mechanism will usually provide ample warning of trouble. And in the same way, a slightly ex-

cessive heat (more than normal) will indicate that some part is badly in need of lubrication or is becoming badly worn.

The intermittent cross movement is correctly known as the Maltese Cross (see Fig. 3). As you can see by the illustration,



THE MALTESE CROSS MOVEMENT

A is the shift pin and B the cam to which it is attached. The 1st drawing shows the cross at rest with the shift pin about to enter one of the slots, 2 shows the cross in motion, and 3 shows the cross checked again as the shift pin leaves the slot. To each complete revolution of wheel B, the cross moves $\frac{1}{4}$ of a revolution. And each time the cross moves, the attached intermittent-sprocket (not shown) pulls one frame of film through the gate. The cross therefore handles 4 frames of film to each revolution, which explains why it is known as a 4-picture cross movement.

the revolving shift-pin on the cam enters the slots in the cross, and to each complete revolution of the shift-pin the cross moves one-fourth of a revolution. If there are four slots in the cross, there will be four interruptions in each revolution of the attached sprocket-wheel, which means that it will shift four frames of film per revolution; thus it is easy to see why it is known as a 4-picture movement.

In narrow-gauge projectors, however, an 8-picture cross and sprocket is used, which implies eight slots in the "cross" and eight stops to each complete revolution of the sprocket. This movement is known as the Geneva, or Octomotive movement. (See Fig. 4).

We have already mentioned that the film must be looped above and below the gate in order to isolate the intermittent motion of the film from the remainder which runs at an even speed. Note that where a cross-movement is employed the bottom loop is formed after the intermittent sprocket—not before or above it. (See Fig. 5).

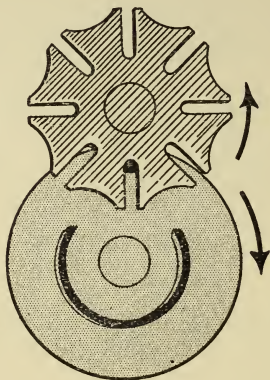


Fig. 4

8-PICTURE GENEVA CROSS

An 8-picture Geneva Cross (Octomotive) movement which drives an intermittent sprocket handling 8 frames per complete revolution of the cross.

Cooling Systems

Projectors fitted with lamps of high wattage need some form of forced cooling, and for this purpose various forms of fans or rotors are employed. Besides cooling the lamp, blasts of air may also be directed at the aperture to reduce gate temperature, and the air intake may be positioned below the projector so as to cool the amplifier as well.

It is very important that the operator knows the position of the air intake, for there he will probably find the largest accumulation of dust and dirt! This can easily be cleaned, of course, by using a soft brush—do it once a month, or after every 30 shows.

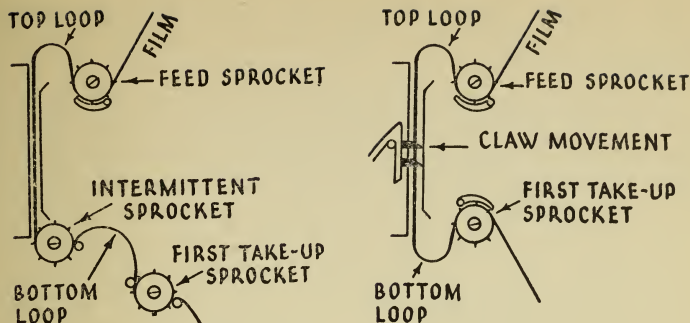


Fig. 5

THE BOTTOM LOOP

The Still-Picture Device and Heat Filters

This device allows the film to remain in the gate for the study of a single frame showing on the screen; and, in order to prevent the film burning or buckling from the heat, a heat filter is incorporated with the device, which automatically drops into position behind the film. In some machines the still-device is operated by using a clutch, which disconnects the motor drive from the projector mechanism.

The heat-filter, being made of glass or perforated metal, usually decreases the screen illumination, and the still-device should not be used in a light-filled hall.

Should no picture appear on the screen when using the still-device it will be because a shutter blade is obscuring the light, and this may then be corrected by turning the motor over by hand by means of the inching knob.

The Feed and Take-up

Most projectors have a braking device within the head of the feed spool-arm, and if a wire belt is also fitted, care must be taken not to project with the belt crossed (unless it is meant to be) as this may cause the braking device to tighten and thereby damage the film.

The braking device should have just sufficient tension to prevent the spool from "free-wheeling" when the motor is stopped.

The take-up may be worked either by direct drive or by friction. In the latter case the ordinary wire belt is favoured, and with some kind of friction device within the head of the take-up arm. In its simple form the wire belt is allowed to skid over one or more pulleys, and thus maintain an even pressure thrust to the spool axis. But this method is not without a number of disadvantages, and most projectors now include an additional friction device within or as part of the take-up head. Friction may therefore be imparted by a number of different methods, and operators should find out for themselves the type of mechanism within the take-up. But this does not mean, of course, that it should be taken to pieces for examination.

One type of take-up head is apparently held together by a single screw, but it will throw out quite a large number of springs and roller-bearings when released by the unwary. (The author speaks from experience.)

Another type incorporates a cork lining within the head, a fact seldom known by many of its users, and with the result that it is not long before the cork lining becomes thoroughly soaked with oil. The cork then breaks up and the take-up fails. The moral, of course, is that you must only oil the correct points, and nowhere else.

But all these different types of take-up heads have one thing in common, and that is the slipping clutch. This consists of two parts: (a) that which is driven by the motor and which revolves at an even rate, and (b) that part which is in contact only (but not mechanically linked in the true sense of the term) and which drives the spool around by its spindle. These two parts may consist of two discs in contact, or a steel spring in contact with a cork lining, and motion is imparted from one to the other by pressure only. But why a "slipping" clutch? The answer is because it has to slip as the spool slows-up with the increasing diameter of film taken up, and it thus provides compensation for varying speed of the spool plus compensation for variations in the "pull" of the film against the last take-up sprocket.

Where such a clutch is fitted, and this includes all modern projectors, note that the wire belt does not skid over the pulleys

but instead is gripped in their "V" shaped grooves.

Many projectors are now fitted with an extremely simple mechanism providing automatic compensation for the increasing weight of the spool as it takes up the film, and this does not usually require any adjustment by the operator.

The take-up must on no account be "fierce," but should be just sufficiently strong to take up the film with a uniform compactness.

The Motor

Electric motors supply power for actuating quite a number of parts in the projector, such as the shutter, cooling-system fan or blower, one or more sprocket-wheels, the intermittent mechanism, and the take-up, etc. In a popular model the motor is of the Universal type, and this means that it can be operated on either A.C. or D.C. (Alternating or Direct Current). Most sound-projectors, however, are fitted with a synchronous-type motor which will only function on A.C.

When D.C. is the only supply available for an A.C. projector a Rotary Convertor must be used, which, as its name implies, will "convert" the D.C. to A.C.

Many projectors run on a voltage considerably lower than the mains supply, and therefore include a transformer or resistance as part of the equipment. You will read more about the motor later on in the book.

Reverse

The reverse-switch should not be used when the projector is running at "forward," unless, of course, your instructions state otherwise. The general rule is that you must stop the motor first, and then restart the motor with the switch in the reverse position. Many projectors fitted with reverse action often "lose" the wire belt from the feed spool-arm, but this should be replaced before using the reverse switch.

The reverse action should never be used to rewind a film, but only to re-show a part of the film which has just passed through the gate. This is another general rule, and does not apply to one or two new machines with a reverse specially designed for rewinding.

Projector Speed

Speed is correctly maintained in modern projectors by means of an electrically-controlled automatic speed-governor, which is actuated by using a sound/silent switch. Sound-speed is at the rate of 24 frames per second and silent-speed 16 f.p.s.

In some projectors the speed may be regulated by the voltage supply, and in cases of sudden lamp failure, the extra voltage (released by the lamp failure) may surge to the motor and cause it to speed up at an alarming rate. In such cases the motor must be stopped at once.

Many silent projectors have their speed controlled by the use of a slide resistance, and with these the quickest method to find the correct speed will be to watch the screen—there must be no flicker, and the pictured movements must appear as normal.

The rate of projector-speed for the various gauges is as follows:—

8 mm.:	100' reel at silent speed:	8 minutes	=12'	per minute
9.5 mm.:	300' reel at silent speed:	12	„	=24' „ „
	300' reel at sound speed:	8½	„	=36' „ „
	300' reel at mute speed:	8½	„	=36' „ „
16 mm.:	400' reel at silent speed:	16½	„	=24' „ „
	400' reel at sound speed:	11	„	=36' „ „
	400' reel at mute speed:	11	„	=36' „ „

Note that mute films are silent versions of sound films, and are to be projected at sound speed.

The Pilot Light

The chief function of this small light is to enable you to see when lacing up the film and also to provide sufficient light for you to keep the film under observation during projection. But should you find that sufficient incidental light escapes from the gate area, the pilot light should be switched off as being unnecessary. The lamp itself is of small wattage and usually lasts for many months, which is probably the reason why it is so often omitted from the list of spares.

The Controls

The controls on a silent projector may be as follows:—
Lamp switch; motor switch; a framing knob (or racking lever);

tilting knob or screws; inching knob (for turning the mechanism by hand); and perhaps a lens focussing-screw or lever. There may also be a speed-control and, of course, the transformer or resistance tappings.

In addition to the above, a sound projector will have another switch for the amplifier, which in most cases also controls the exciter lamp, plus tone and volume controls. All these controls must be checked before each show.

3

The Sound Projector

Sound Films

THE sound-track is printed on the film, and if you examine it closely you will see that it consists of a series of black and white shades of different intensity, or perhaps a saw-tooth pattern upon a transparent background. The former is representative of the "variable density" type and the latter of the "variable area" type. In reproducing sound a narrow beam of light is passed through the sound track and directed on to the photo electric cell, and as the latter *reacts electrically* according to the variations in the light waves directed upon it, we are presented with the phenomenon wherein light-waves are changed into electrical impulses capable of producing sound waves when fed into the loudspeaker amplifier circuit.

Scanning

In the scanning-system light is introduced either by means of a low-voltage lamp incorporating a single spot-filament, or by guiding it from the bottom of the film projection lamp. In the former case the small lamp is known as the exciter lamp, and in the latter case use is made of what are termed the exciter rays. The light which strikes the sound track is known as the scanning beam. It is clear-cut and of uniform intensity, and is usually produced by the passage of the light through an extremely small slit (.0004 of an inch wide) between two metal facets (Fig. 6).

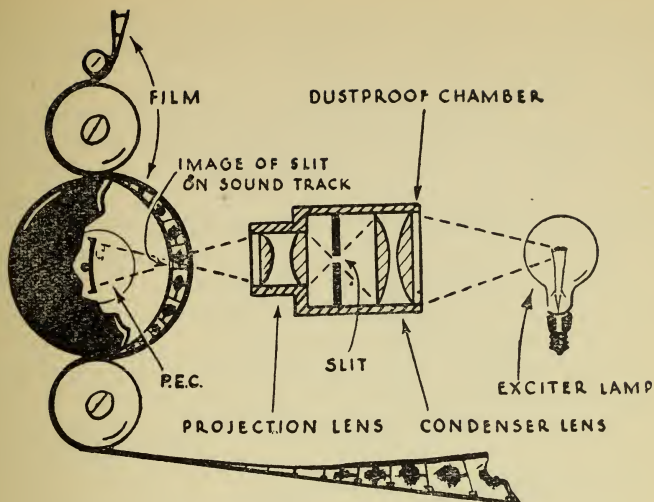


Fig. 6

THE SCANNING SYSTEM

A cut-away view of the Photo Electric Cell within the sound-drum. The illustration is based upon the "average" 16 mm. projector. Both the exciter lamp and the sound optical system are usually adjustable, but any adjusting or servicing of these parts must always be carried out with extreme care and gentleness.

This tiny slit must be kept completely free from dust, and it is usually sealed up in a dust-proof cylinder which also contains the condensing and projector lenses of the sound-optical system. In some projectors the light is reflected onto the photo-cell by means of a prism, and this, together with all exposed parts of the system, must be kept absolutely free from dust, a single speck of which may ruin the sound.

The Photo-electric Cell

WE have already mentioned that the photo-electric cell re-acts electrically according to the amount of light directed upon it, and also, that variations of the light are produced by variations in the shading of the sound-track.

Rather like a small valve in appearance, the photo-electric cell also contains a cathode and anode. The cathode, however, consists of a plate on which is coated a light-sensitive substance.

When this substance is exposed to light (excited) it re-acts by producing a stream of electrons, or rather, it produces an electric current.

As the light (from the exciter via the film) is increased, the current thus produced increases correspondingly. When the light varies rapidly, the current likewise varies. The current produced by the photo-electric cell is quite small and to guard against loss by resistance and possible interference, it is placed very close to a special valve which has as its primary function the immediate amplification of the current. In the average amplifier, this valve and its attendant circuit form what is known as the pre-amplifier, or pre-stage.

If the photo-electric cell is allowed to become coated with dust it will be prevented from receiving the full strength of the light directed upon it. It will then produce a much smaller current, resulting in loss of volume. So the photo-electric cell must, of course, be included in the weekly clean.

Exciter Lamp

This little lamp, being in most cases fitted with a bayonet cap, can be inserted either of two ways—the right and the wrong way. You will notice that the filaments are formed by two up-rights and a cross-piece, and it is the latter which provides the illumination. If the lamp is wrongly inserted, one end of the top filament will be nearer to the optics than the other, which means that one side of the sound-rack will receive a greater degree of illumination. This in turn will result in unequal volume between bass and treble frequencies of sound heard from the loudspeaker.

The exciter lamp shown in Fig. 6 has been drawn specially to show you what the filaments look like, but you know now that in actual practice the lamp must be inserted so that the top filament is parallel with the face of the sound-lens.

The Smoothing System—Damping

The smoothing system consists of a series of rollers so arranged that the film passing the scanning-beam is completely steadied, both as to lateral movement and the irregularities in its speed. In many projectors a heavy flywheel ensures that the film is carried along at an even rate, pressure rollers keep the

film flat upon its surface, and others smooth out the difference with the rest of the film by means of resilience. (Fig. 7).

In one well-known projector the system of rollers is called the Oscillatory Stabiliser, an excellent description.

If any part of this system becomes faulty a variation in the

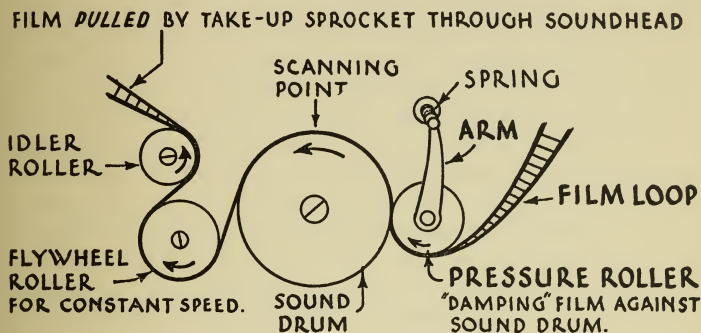


Fig. 7

' DAMPING '

A pull-through type of soundhead without sprocket-wheel.

speed of the film passing through the sound-head may result, and this will cause an unpleasant "wow" from the loud-speaker. Correct sound-speed must always be maintained, as any increase or decrease in the speed will result in the sound becoming sharp or flat respectively, and in much the same manner as the gramophone when its speed is altered. Should a sound-projector be run at silent-speed then the resulting sound will be terribly flat, as the silent speed of 16 frames per second is much too slow for perfect reproduction.

All rollers in the smoothing system must be kept absolutely clean, and those fitted with a spring must be at just the right tension. Some rollers may have to be held back when threading the film, but care must be taken not to allow them to fly back into position, otherwise the sudden pull on the film will result in the sprocket holes becoming strained or torn.

It should be noted that in some projectors these rollers do not require oiling, but instead are to be clean and highly polished.

The Amplifier

THE AMPLIFIER may be built into the projector or be provided as a separate unit, and in some cases it is housed in the loud-speaker assembly case. Its function is precisely the same as any other amplifier and it may be used to amplify sound from an electric gramophone or mike, as well as the impulses from the photo-cell.

The gramophone is no longer required to provide sound in synchronisation with the film, and it is easy to see why it is now known as the non-sync (non-synchronised).

The sound reproduced by the non-sync is often louder than film-sound, and this is because the photo-cell has a limit to the amount of light it can deal with. An over-loaded photo-cell is a rare occurrence in 16-mm. projectors, but it may be possible in some machines when the volume is turned on full. When this happens the cell can be seen to fluctuate with light, and a drumming noise may be heard from the loud-speaker. The photo-cell (but not the amplifier) is then working at its maximum efficiency. Any amplifier may become faulty in a hundred different ways, so always handle it with the utmost care.

It is the usual requirement to switch the amplifier on at least one minute before projecting, in order to give the valves time to warm up.

It is more than probable that you will find that the voltage supplied to the amplifier is different from that supplied to the lamp and motor, so look for some reference to this in your operators' instructions. You will also find, perhaps, that there is a small fuse somewhere in the amplifier, and on no account should this be changed for one of a higher rating. The amplifier fuse is usually one of 2-amps, and in the event of it blowing it must not be replaced by a 5-amp fuse. But 2-amp fuse-wire cannot be bought at every shop, so start looking for some now—do not wait until you need it in the middle of a show.

The output of an amplifier, in wattage, can be made to vary considerably by the current fed to it. Insufficient volume may therefore be caused by low voltage, a fault which can usually be speedily corrected by adjusting the transformer or resistance. But to increase the voltage above the correct rating for the amplifier would also cause a fault, and quite a serious fault it would be—a complete set of new valves being the remedy!

Remember too, that excess voltage fed to an amplifier will also produce an excessive heat, which may result in a whole train of minor faults.

Another thing to remember is that no two amplifiers are the same in design, and a wiring-chart is nearly always necessary when carrying out certain repairs. But wiring-charts are often difficult to obtain, and are seldom included in the operators' instructions issued with the equipment. Service engineers are supplied with them as a matter of course, but not operators. Are we to understand from this that the manufacturers do not want you to meddle with the amplifier? (Yes!).

The average operator should concern himself only with the care and actual use of the amplifier. He should know how to clean it properly, how to change valves, and how to adjust the voltage supply correctly, and those are the things which are explained later on.

Never jerk or jar the amplifier. If you do, then you must expect to get an electric shock from it one day. Continual jarring of the equipment will eventually loosen and move some component against the chassis and thus cause the latter to become alive. You will know at once when this happens, and will find some difficulty in carrying on with the show. (The cure will be to earth the projector, and stand on a rubber sheet or thick wooden boards—all very dry). So always handle the equipment with a great amount of care.

Valves

Most amplifier valves deteriorate slowly, and give a certain amount of warning before finally giving out, so if you don't possess a complete set of spares (which you should) you must at once take steps to obtain a replacement. Each valve is numbered, and if, for instance, you find the faulty valve is marked 6J7 then you should ask or write for a 6J7. It is possible, however, to use an alternative, and almost all radio dealers keep a number of books listing them, but alternatives should not be used unless necessary.

Valves are wired either in series or in parallel. (See Fig. 8). Note that in series winding the failure of one will interrupt the circuit and cause the lot to go out, but that if they are wired in parallel you should be able to see which particular valve has

failed, as the others will remain alight. This is further discussed in the chapter on Fault Finding.

The correct way to remove a valve is by taking hold of its base, not by the glass bulb. Use a cloth to hold it (if it is very hot), and lay it down gently.

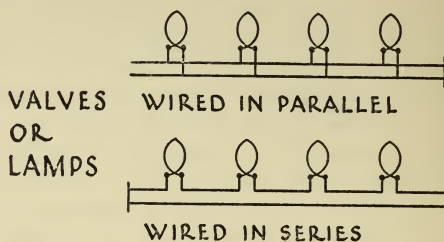


Fig. 8

Note that in series wiring the failure of one valve will completely interrupt the circuit and cause the lot to go out.

The Loud-Speaker

The Loud-Speaker should be the least troublesome part of your equipment. It requires very little adjusting, and has only to be kept clean and not knocked about. But the speaker base is nearly always magnetic, and this should be periodically examined to see that it has not collected a few hair-pins or the nail-file you lost the week before. The magnetism is also likely to upset your watch, so do not wear it when handling the speaker.

All manufacturers of sound equipment supply loudspeakers which are a perfect match for their own projector sound-systems, so if an additional speaker is required, remember that it too must be a perfect match. This means that the speakers must be of similar resistance, impedance, and work on the same power-supply without impairing in any way the quality of the sound. The use of an extra loudspeaker, however, does not imply extra volume. You will get better sound, perhaps, but not necessarily more of it.

Any particular note in music (or other sound) may be described as a high (treble) note or as a low (bass) note of so many frequencies. The range of frequencies audible to the human ear extends from about 16 to 16,000 cycles per second. That pro-

duced by your equipment, however, may range from about 40 to only 8,000 cycles. If it can reproduce sound at 10,000 cycles you can congratulate yourself as being the owner of a fairly good machine. But can a single speaker do full justice to such a range of sound? The answer to that question is—very seldom.

Sound, as a natural phenomena, has a number of peculiarities, and one of these is that many of the upper frequencies are more "directional" than those lower down the scale. These frequencies can actually be "beamed" at the audience with great affect, and that, in a nutshell, is why you must tilt the loudspeaker slightly downwards. But a second speaker, for treble reproduction only, will go far towards helping you to give an excellent rendition of all the sound printed upon the sound track.

We have already learnt that the photo-electric cell produces a current which varies in step with the light modulated by the sound-track, and that this current is next given a slight increase in power by the pre-stage valve. What happens next is that each succeeding valve also gives it an increase until it is of sufficient power to work the loudspeaker. This particular function of the valve, however, must not be taken to mean that there is only one circuit carrying the current to be increased, or amplified.

Each valve has its own circuit, and each valve produces an increase in power in the circuit next to it. Amplification, then, is a matter of increasing power by stages. (Valves have other functions, of course, but further theory would be out of place in a book such as this).

The powerful current finally produced, still carrying the frequencies originally produced by the photo-electric cell, is next carried along the speaker cable to the heart of the loudspeaker.

Loudspeakers also vary in design, but each will enable the current to actuate in some way the speaker diaphragm. Sound is then produced by the diaphragm vibrating in sympathy with the current frequencies. The air carries these vibrations until they reach our ear-drums, which also vibrate and thus enable us to hear.

The efficiency of any loudspeaker, then, depends on the ability of the diaphragm to vibrate at an enormous yet varying speed to produce those waves of sound. Any damage to the diaphragm, or the adherence of dirt, for instance, may therefore seriously

impair the quality of the sound and ruin the show. As with all other parts of the equipment, the speaker must be kept perfectly clean and in good order.

Sound Conversions

Can your silent projector be converted to sound? The answer to this question, as stated in the opening chapter, is that if your machine is worth converting there is nothing to stop you from having the job done. We do not advise you to attempt the job yourself, however; it is far from easy, and the finished job has to be as near perfection as possible if it is thoroughly to justify the cost.

Remember too, that sound-speed is considerably faster than silent-speed, and that the motor and mechanism must be able to stand up to the extra strain, which was certainly not allowed for by the manufacturer. Have your projectors converted by all means, but do not expect the same results that you would get from a new sound-projector.

The following makes of 16-mm. silent projectors are those usually converted by firms specialising in this work—you will find their addresses in the *Amateur Cine World*: Ampro, Bell and Howell, B & H-Gaumont, Bolex, Debie, Kalee, Kodak, Pathe, Siemens, Specto, and Zeiss, plus a number of other machines now being made. But note that the author is making no recommendations! On the other hand, complete conversion-units are available for certain new projectors, and these are usually sold with instructions to enable you to do the work yourself.

Synchronising Gramophone Records

Many owners of silent projectors have to depend on the gramophone disc for their sound, whether it be music, commentary, or the "effects" they have made themselves to go with their own films. Thus amateurs take advantage of the special facilities offered them by the disc-recording companies, and there is no limit to the type of sound which they can now hire or have made for them.

If you are about to choose music to go with a certain film, you should ensure that tempo and mood of the music will not clash with it, and you will have to carefully study the list of "mood

music" sent to you by one of the gramophone companies. But it is in recording your own voice and making your own "effects" that you can enjoy the added thrill of creative art, and no-one who has ever done so has thought about the price of art when listening to himself. Most people are literally staggered by what they hear . . .

The record you hire for mood-music may be for gramophone speeds of either 78 or $33\frac{1}{3}$ r.p.m., but the latter speed should always be chosen when recording for film accompaniment. The slower speed, of course, will give you more sound per disc.

There are two methods of synchronising the disc with the projector. The first of these is simply guesswork, both as to correct starting and correctly maintained synchronisation during a performance. The first part of the job is to get the gramophone running at the same reproduction speed as the projector, and this usually entails considerable time, patience and lots of practice. But once you have got the speed of both "in sync" your troubles are nearly over.

If the record is to provide a commentary to a film, your next job will be to find out where to place the needle so that the sound starts at the right time—when the first picture-frame is projected, for instance. A good idea is to start the record first, and then to start the motor at some particular sound. This entails memorising your own sound-cue and noting the section of film which has to be laced up in the gate. When you have done that you should be able to start the show with apparent ease.

The second method is to have the gram and projector-motor mechanically linked to each other, which is the only way in which perfect sync can be achieved and maintained. This naturally entails a certain amount of engineering, dependent on materials available and your success in getting someone to do it for you. Readers requiring expert information to meet their specific needs are invited to write to Modern Messages Ltd., 9, Piccadilly Arcade, London, W.1, a firm specialising in providing disc-recorded sound and apparatus for the amateur film user.

4

Additional Equipment

Resistances

THE external mains resistance has as its principal function the lowering of voltage supplied to the projector, and it may be used on either A.C. or D.C. mains supply. It is essential to connect it according to the maker's instructions, and adjustments should be checked before the start of each show.

It has no working parts requiring operation during projection, though it is possible on certain types of variable resistances to adjust the voltage whilst in use. Those on which no adjustment can be made are known as fixed resistances.

The variable types may have either a series of tapping-points marked with the different voltages obtainable, or be fitted with a sliding knob and pointer which can be moved along a graduated voltage scale. The latter type may be known also as a rheostat, and with many of the older types of projector it was supplied as a means of controlling the speed of the motor (in the absence of an automatic governor).

You will notice that the exterior resistance gets quite hot when in use, and it is best placed under the projector-stand where its heat will not affect the films and records, and also, in a position where there will be a free flow of air around it.

The output voltage-reading should be taken after the resistance has had time to warm up sufficiently to produce a steady current. After final adjustments, it should be left alone until the end of the show unless, of course, you are using it to "fade" the lamp on and off, which will lengthen its life.

Transformers

Transformers carry out the same function as resistances, but do not give off any appreciable heat. They must not be used on

D.C. A favourite type of transformer is one fitted with an automatic tapping-control, which allows the voltage to be adjusted whilst the projector is in use. It is also fitted with an illuminated voltmeter.

When adjusting the transformer always remember that to increase the voltage you use a lower tapping, and to decrease the voltage you use a higher tapping. (i.e.) To increase the voltage by 10 when the tapping is set at 230, adjust it to read 220.

Electrical Connections

All electrical circuits for lighting and power are somewhere fitted with a small section of wire which, because it is weaker than the rest of the circuit, will immediately fuse and break in the event of overloading. And that particular section, as you already know, is what we call the fuse. The fuse is a safety valve, and must be considered and treated as such. It can prevent damage to your equipment, provide a warning against overloading, and at times may possibly prevent your house from catching fire. When a fuse blows it must not be replaced by a hairpin, a nail, a paper-clip, nor anything else other than a new fuse of the correct rating.

The fuse governing household lighting-circuits is usually one of 5 amps. For domestic heating and power, 10, 15 or 25-amp fuses may be in use. And the rating of the (original) fuse is your best indication of the normal load for any particular circuit providing, of course, that it was fitted by a competent electrician.

It is quite possible that your equipment can be connected to the lighting-circuit without blowing the fuse, which means that the current then set in motion does not exceed 5 amps. But should you use extra equipment on the same circuit (another projector or an electric fire, for instance) and replace the normal fuse for one of 10 amps, you would then be guilty of overloading and would at the same time make your fire insurance-policy not worth the paper on which it is printed.

You are not to connect any projector to a domestic lighting-circuit. Instead you must use a proper power-point. This is a general instruction and an important one, irrespective of the fact you may be able to prove otherwise.

Ever had an electric shock? One way of preventing shocks is by effectively earthing the projector, which means that it has

to be connected by a wire of low resistance to the earth or to a water pipe, for example, which leads directly to earth.

Manufacturers of equipment often supply a 3-core cable for use as a mains lead. The third wire, which should be connected to the largest (earth) pin in a 3-pin connector, is your ready-made safety earth-lead. In the event of a short circuit, such as happens when a wire or component comes in contact with the projector casing, the current should be able to flow directly to earth by the nearest route. And the route should be via the earth-lead—not via the operator.

If, however, you find that your projector is supplied only with a 2-core cable or flex, you can add the earth yourself. All you need is a length of good copper wire fitted with metal clips at each end, and if the clips are also of copper so much the better. One end of the wire is attached to the projector and the other to the nearest water pipe, but do scrape away any paint or grease which might impede the current, and ensure that the clips really do make proper contact. Note that a faulty earth-lead is not an earth at all—a statement paradoxical, perhaps, but yet perfectly true.

Non-Syncs

Non-syncs are now available to match most 16-mm. equipment, but care must be taken to see that they are connected with the correct voltage supply. For instance, you must not connect the non-sync to the output side of a resistance or transformer if it is meant for a voltage similar to that of the input or mains side.

Many kinds of needles are available for the non-sync, and those advertised as having a long life and capable of playing 60 records or more are most favoured by operators. They are also the kind most likely to damage your records. If you cannot be bothered to keep changing the needle then you are advised to use a special sapphire stylus which will not require changing, but which, unfortunately, is rather expensive.

The correct methods for connecting non-syncs to the mains, etc., are described in the chapter on Exhibiting.

Microphone and Other Sound Additions

In most sound projectors there is an insert for a jackplug, by means of which either a microphone or the non-sync can be

connected to the projector's amplifier, thus permitting commentaries, recorded or otherwise, to be made during the screening of silent films, etc. (The jackplug is a 1-pin plug of the type used chiefly on telephone exchange-boards).

When inserted, the plug may automatically cut out film-sound, thus allowing you to change over from film-sound to mike or non-sync merely by using the plug alone. You must find out whether this is so or not because, in the case of you being able to use the non-sync (with the projector running) without automatically or otherwise cutting out film-sound, there arises the possibility of trouble when using the non-sync with a *silent* film.

Just imagine for a moment that you are about to use a silent film on a sound projector and also that you are going to use the non-sync or the mike during the performance. Naturally, the first thing you do is to switch on the projector's amplifier, which in most cases means that the exciter will be switched on as well. Now if the exciter lamp cannot be switched off while you are using the amplifier, then the exciter will excite the photo-electric cell via the perforations in the silent film and the nasty noise you then hear from the loudspeaker will be one of 16 cycles per second! (16 frames or perforations per second for 16-mm.).

You are quite likely to experience this trouble should you be foolish enough to include a silent film in a programme of sound films, and if you are unable to switch off the exciter or in some way interrupt its rays there will be nothing else to do but remove the exciter itself. But can you switch over from sound to silent speeds without stopping the motor? This is something else which must be checked in your operators' instructions.

The mike intended to be used with a sound projector must also be a perfect match and before buying one it is always preferable first to approach the makers of the projector to see if they can supply one, or at least tell you the type to get. Do not make the mistake of thinking that any microphone can be used on your equipment.

Using Microphones

When in use, the mike should be held at a distance of about six inches in front of and facing your mouth. (We are talking about the type supplied with projectors). Holding the mike on one side or practically mouthing into it is seldom necessary.

If it produces from the loudspeaker a howl like a banshee in torment, you are either too near with it to the projector or speaker, or the volume is at too high a level.

Lots of fun can be had with the mike, but for all public occasions its use should be rehearsed prior to the performance. You must note beforehand the volume setting which will be required by the person using it, and you must not allow it to reproduce unwanted sounds.

The volume control should be adjusted only a moment or two before the person begins to speak and you must be ready to lower the volume momentarily should you see him about to cough or sneeze. As soon as he has finished speaking, lower the volume. Never allow the mike to be placed on a table before the volume has been lowered, otherwise the audience may be startled as though by a minor explosion.

Another unnecessary habit is that of testing the microphone by knocking it with your knuckles. That sort of treatment can quite easily cause a lot of damage, especially with "crystal" mikes. The correct way to test it is by speaking into it, normally.

Rewinders

Some projectors are fitted with a rewinding device, but if this is absent a special rewinder will be required. A simple one may be made by mounting two spool-arms in an upright position upon a smooth board, and providing the right-hand arm with a winding-handle, preferably geared. There are many rewinders to choose from on the market, and some incorporate illuminated viewing-panels and splicers. Many, of course, are highly geared, but this last is a doubtful attraction, for rewinding should never be done at high speed.

Always keep the rewinder greased or oiled, and any checking or tensioning-device correctly adjusted. If there is no such device on your rewinder then you should lightly check the feed-spool by hand when using it. This will prevent the film jumping should the feed-spool tend to race the take-up spool. And, of course, make sure that the spools are not likely to fly off the rewinder.

The spool-arms should also be kept correctly aligned and stable.

The size and shape of rewinder spindles are similar to those

found on the projector spool-arms. 8-mm. and 16-mm. are exactly the same and spools in these gauges may be used on the same rewinder. But a different rewinder will be needed for 9.5-mm. size spools.

A bi-film rewinder is one on which both 9.5-mm. and 16-mm. spools may be used.

Splicers

A Splicer is used for correctly joining together two pieces of film, and good ones are provided with an attachment for scraping the emulsion from the film. The majority also include a part for cutting the film, either at an angle or straight across. Joins made at an angle are considerably stronger than transverse joins, and help to reduce the faint "plop" sometimes heard when the join passes through the soundhead. (The correct method of joining films is described in the chapter on Film Care.)

As with other modern accessories, splicers are now made for use with any of the different film sizes or for a combination of sizes. A universal splicer is one on which the film-locating pins are so arranged that films of 8, 9.5 or 16-mm. may be used.

Cables and Connectors

Cables and plugs should always be clean and dry, and the insulation periodically examined and repaired. The mains cable should not consist of a length of 5-amp lighting flex; power cable should be used (Fig. 11). Cables should be coiled in such

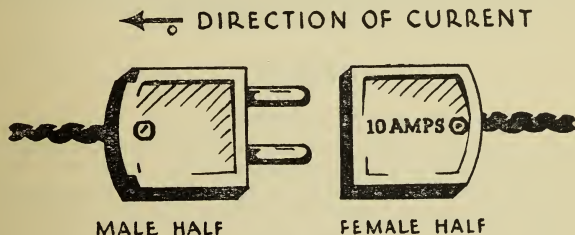


Fig. 9

THE 10-AMP FLEX CONNECTOR

The "male half" must always be on the dead side of an electrical circuit.

a manner as to prevent them from twisting, otherwise they will eventually develop kinks and then probably split. Any joins in

the cables must be correctly made to prevent them from coming apart, and should be well protected with insulation tape, the latter wound in such a manner that its width is gradually tapered down to the width of the cable. Permanent joins should be painted over as an added protection, but it is most important to see that the wires within are securely spliced (Figs. 10 and 11).

Plugs made of bakelite should also be covered with insulation tape, as this will prevent them from breaking if dropped.

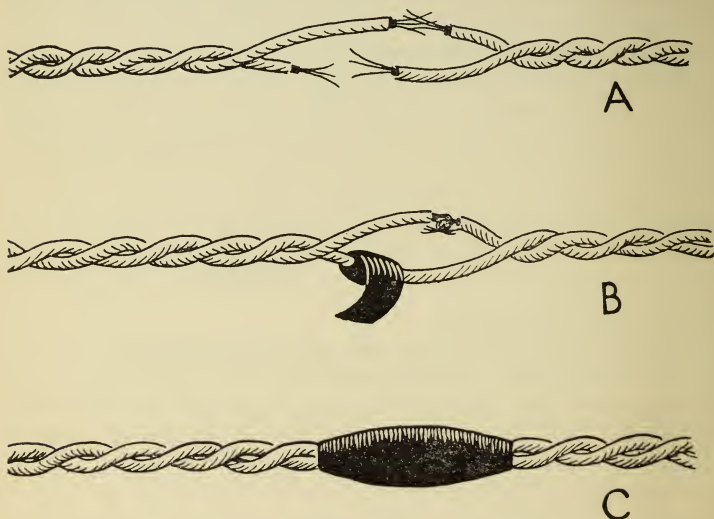


Fig. 10

JOINING TWIN FLEX

- A Cut the two ends so that they are of unequal lengths, and then splice the wires by joining a long end to a short one. Staggering the joints will prevent a lumpy joint from being made, and also lessen the chance of a short circuit through faulty insulation.
- B Apply a little solder to each of the joins and then bind them with insulation tape. If no solder is available, splice the wires in such a way that they cannot be pulled apart.
- C Twist the flex to normal, then apply the outer bindings of insulation tape. When you have finished, rub the join between your hands for half a minute—this will make all the bindings stick more firmly. Test the flex at the first opportunity by connecting it to a lamp or volt-meter.

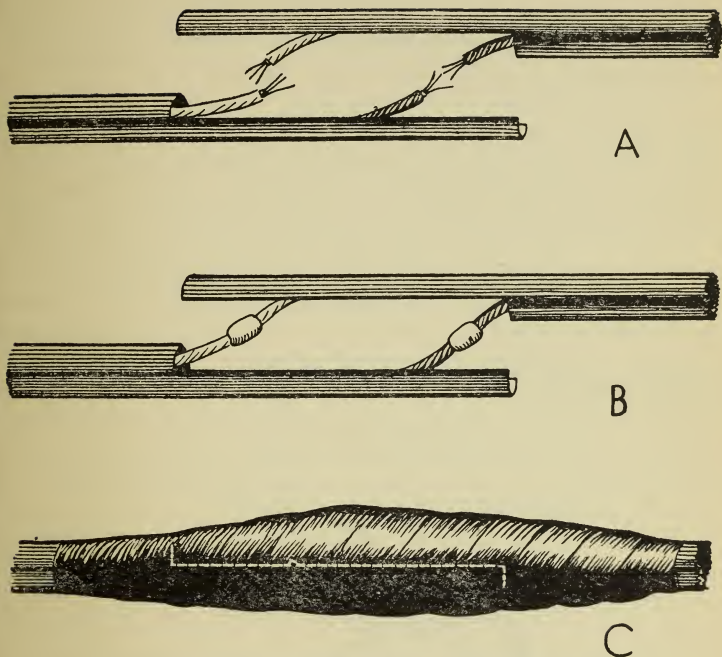


Fig. 11

JOINING TWO-CORE CABLE

- A Cut away half the outer cover as shown, and then cut the inner wires so that one is longer than the other. Remove as little of the inner insulation as possible.
- B Splice and solder the wires together, but be careful to match the colours of the inner insulation. Test the joins by pulling before taping them.
- C If the outer covering has been correctly cut it should now be possible to fit the ends together without any part of the join exposed. It must now be covered by insulation tape, and bound as tightly as possible. Next roll the join between your hands to make the tape stick properly. The finished join may be further protected by a coating of paint, especially if it is to be used out of doors.

Quite a large number of projectors may be connected to any lighting system, but this is theoretically wrong, and you are advised to use a proper power-point whenever there is one available. If there is no such point then you should connect your mains-lead to the fuse-box. The wires may usually be held in position by the fuses themselves, and without having to undo any screws. But always choose a pair of fuses supplying a circuit having no other load than that of your own equipment.

The cable used for the loud-speaker may have any number of wires inside it, and because of the difficulty in replacing a broken speaker-lead connector, you must pay special attention to preventing the latter from ever becoming loose. To replace a connector to a six-core cable is not an easy job—there are 36 different ways you can do it, but only one is the correct way. And three or four of the other ways are likely to blow a valve or short-circuit something. However, most speaker-leads consist of a two-core cable, and may be reversed without causing any damage. Sometimes it is necessary to use a three-core cable in conjunction with a two-pin adaptor and Fig. 12 shows how this should be done.

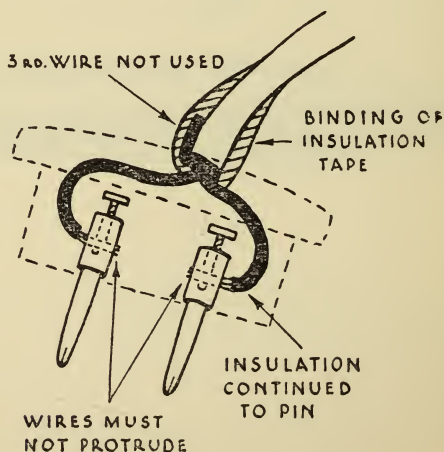


Fig. 12

How to connect a 3-core cable to a 2-pin adaptor.

Equipment for D.C.

Electrical apparatus may be supplied for use on A.C. or D.C. mains, or be of the type known as "universal", which implies that it can be used on either A.C. or D.C. with no apparent after-effects. A truly universal model, however, is one which can be used on either type of mains without employing special equipment. The majority of projectors are for A.C. supplies only, a few are universal, and D.C. models (in Britain) are a rarity.

Most of the troubles experienced by operators occur when using A.C. machines on D.C. mains, but after discovering that the audience won't put up with a strong smell of burning and no picture, they at once switch off and retire to a corner to read their operators instructions. They may then read, for instance, that the motor is universal and that the amplifier is A.C. only, in which case there are two methods of dealing with the connections to the mains.

The first method, which is by far the simplest, is to connect up the whole of the equipment to a rotary convertor so that it may all operate on the A.C. supplied by it.

The second method would be to use the convertor to supply A.C. only to the amplifier, the motor (and the lamp) being connected direct to the D.C. mains. But note that this method may entail using a resistance for the lamp and/or motor, as a transformer must not be used on D.C. The transformer may be used, if required, by connecting it up *between* the convertor and amplifier. (Fig. 13).

Providing your rotary convertor is of sufficient power, it is usually best to take full advantage of it by connecting the whole of your equipment to it.

Other D.C. equipment, such as vibrator packs and polarity changers, are supplied with one or two makes of machines, but the rotary convertor is considered as standard equipment for professional use. It is actually a combination of a D.C. motor driving an alternator (or A.C. generator) and it is more economical to run than other equipment which includes a mains resistance. Those supplied for use with sound projectors average between 50 and 60 lbs. in weight (their only drawback) and handle up to 2,000 watts—giving ample margin for two projectors employing high-wattage lamps, etc. But a wide range

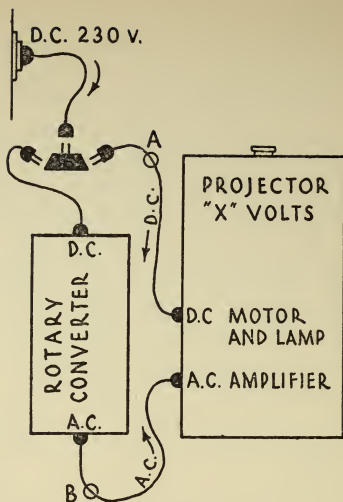


Fig. 13

AN ALTERNATIVE METHOD OF CONNECTING TO D.C.

'A' marks the point at which a resistance could be connected if required, and 'B' where a transformer could. Check your operators' instructions to see if lamp and motor switches are to be worked simultaneously.

of more or less powerful convertors are, of course, available for use with specific equipment.

Spools and Containers

Spools should not be used if they are bent or rusty, and should always be perfectly clean, straight and smooth. When a spool is slightly bent and it has to be used at once, the film should be twisted once so that its edges do not touch the sides of the spool. Bending the spool back into shape is best done by hand, and without the use of any instrument liable to scratch.

Spool tins should be fitted with bevelled edges, or with a simple device for easy opening. Many spools are damaged because the operator has not been able to open the tin without the aid of a screwdriver, thus endangering both the spool and film within.

Projector Stands

Stands should be quite rigid and stable, and not of the kind which will fall over if someone happens to brush against the projector. There are quite a few stands of the collapsible kind, but avoid those made unusable through the loss of a single screw. If possible, get one which will remain standing even though all the screws are removed or loosened, and see that the top platform dimensions are larger than the lateral dimensions of your projector. For static shows a solid wooden one should be made, perhaps incorporating a stand for the projectionist as well, and so made that he can easily reach the topmost spool.

For professional use, a stand measuring at least four feet in height should be used. If a higher stand is purchased do make sure that you will be able to reach the top spool-arm.

And if you are giving shows in other peoples' homes you will need a stand which has rubber feet, otherwise you might perhaps damage the linoleum or carpet.

Stands which have adjustable feet are very helpful, but it is not necessary to get one with an adjustable platform. The projector should be tilted—not the platform. If the platform is tilted the vibration from the mechanism and motor will slowly move the projector about and perhaps even cause it to fall off. Keep the platform level for safety.

Films and Film Care

Cleaning Films

THE GREAT ADVANTAGE which narrow-gauge film has over 35-mm. is that it will not easily burn, but it may still be easily damaged by heat, and therefore requires just as much care as the highly inflammable stock.

Narrow-gauge films are made from a material usually called cellulose acetate, but this describes the base only, and does not include the emulsion, delicately coated on the picture side of the film. The film may also be treated with a special hardening process, and on top of this may receive a coating of protective wax. Films which have been so treated may be used for about 400 shows before being scrapped, but although this is possible very few of them are ever in a fit condition for the 400th show, having been severely mishandled by a series of operators who should have used a little more care, but didn't.

The utmost care must be taken of the films in your possession, and at all times you must guard them against the possibility of damage. Never handle them with oily hands, keep them covered to prevent dust from settling on them, and never place them near a radiator or fire. Films which have become dirty or oily may be cleaned with carbon tetrachloride, or with a proper film cleaning-fluid, of which there are several on the market. Saliva should not be used, as it invariably removes the picture!

In cleaning, the film should be passed through a cloth moistened with the cleaning-fluid, but this should be done very slowly to allow the film to dry before being wound onto the spool.

Dangers of Mutilation

All film should be wound on the spools, reasonably tight, and never allowed to trail on the floor or to touch anything else, and on no account should the film be handled except by its edges.

If it is wound loosely it will skid when pulled from the spool, and the surface may thereby be damaged. Loose film also allows dust to settle on its surface, and will definitely increase the damage when the film is used.

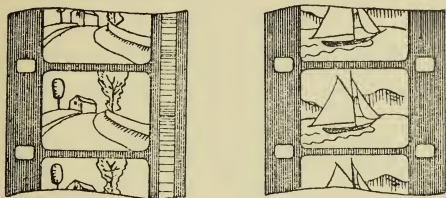


Fig. 14

16-mm. film. Sound film has only one row of perforations, and cannot, therefore, be used on silent machines fitted with double sprocket (teeth) rows. (Enlarged reproduction).

When making up a programme which requires a number of films to be joined together, care must be taken not to cut into the sound track. Every time a film is joined it loses a part of its length, so guard against this form of damage by using a piece of blank spacing between each separate film to be joined. If possible, remove the leaders of a film by carefully separating the joins, and then add your blank spacing without cutting the film which provides the picture or sound.

The blank spacing is merely a length of perfectly black film, and a piece about six inches in length should be used to separate the different films (not parts) which have to be joined. The leaders of each film or part of a film which come first on the spool must be left intact, and this also applies to the last part of a film—the trailer.

You will notice that each library film has two different kinds of leaders attached to them. The first leader is a length of white-opaque film used for threading the film in the projector, and this is the only part of the film which may be removed, and replaced, by the operator when making up a programme. Between that leader and the first picture-frame is another leader

which contains picture and sound "start" frames plus a series of numbers. This is the synchronising leader which is used in dual projection, and under no circumstances may the operator cut or in any other way mutilate it. If the sync-leader is shortened in length it will certainly complicate things for the next operator who tries to use it in making a change-over from one projector to another ; all of which is explained in a later chapter.

Definitions

It should be noted that common usage in the 16-mm. world has slightly altered the meanings of certain terms, but the following are those in general use to-day:—

Spool.—This is the metal container which holds the film for projection. Sizes in use are 50', 100', 200', 400', 800', 1,600'. The 2,000' spool is also coming into use, but cannot be used on some projectors without extending the spool arms. Unless a spool is correctly filled it cannot be used to denote any particular length of film, and the term "spool" can therefore only be of use as a measurement by virtue of its capacity alone.

Reel or Part.—This is 400' of 16-mm. film. However, many "parts" of a film are *not* 400', especially the last parts, and the term "reel" should be used as the standard measurement alone. If we examine a 1,600' spool just received from a library we shall probably read something like this on the label:—*The Grapes of Wrath*—Parts 1—4.

Now although the first three parts may be of 400' each, it is quite possible that part 4 may be only 300' in length, and this is usually the case with the last part of the last spool. The term "part," therefore, is a very doubtful measure, and the term "reel" should always be used to denote a standard length of 400' of film. A film in 4 parts *may* be 1,600', but on the other hand it may be considerably less.

Film Stock.—This usually refers to "raw" unexposed film, but may be used to describe a type of film, such as nitrate or acetate stock, etc. "Green" prints are those which are new, and which perhaps may give a little trouble by causing unsteadiness of the screened picture. The cure for this is to slacken the gate pressure until the picture becomes steady again. After a film has been projected five or six times it loses a certain amount of

its moisture-content and free surface particles, after which it should give no more trouble and ceases to be a green print. But remember, when slackening gate-pressure, that you must re-adjust the pressure very carefully, afterwards re-setting it at normal pressure for subsequent films.

If you find that you are unable to adjust gate-pressure and the picture has the jumps, try partially opening the gate. Other methods of curing jumpy pictures caused by green stock are (a) to wax the gate side-pressure rails, and (b), to apply a faint smear of oil to the outer edges of the film. Note that the author does not recommend either method. Film libraries should adopt the general practice of waxing all films before sending them out.

The faint specks which may be seen on the screen during projection are the results of the "grain" in the film, and for many years this has been the subject of extensive research by the manufacturers. A very fine grain stock, however, is now available and is in general use for making 16-mm. prints.

Protecting Films

All films are affected by heat, and those which have been allowed to dry thoroughly eventually become brittle, and will crack when run through a projector. The moisture content in the films can be preserved by keeping the film tightly wound on the spool, and the spool kept in its can when not in use. An extra precaution is provided by the use of special airtight cans incorporating an absorbant disc moistened by a humidifying solution, but this should not be overdone, especially in view of the fact that the air is usually damp in certain parts of the country.

Scratches appear on the screen in the form of black lines giving the appearance of rain, and in all such cases the fault lies with the operator who failed to keep his projector clean or the film covered.

It should be remembered that all projectors draw in a certain amount of dust, and this is especially so in the case of projectors fitted with a forced air-cooling system. The dust mixes with the minute scrapings of emulsion-dust, and before long will build up into hard little lumps capable of scratching a film throughout its length. Good operators make a point of quickly cleaning the gate after each spool during a show.

Spools should never be overloaded, but should you receive a spool with the film overlapping at the edges you are advised to transfer it to a larger spool before projecting; otherwise you are likely to get into difficulties with the take-up, and will find it necessary to guide the film on to the take-up spool as it nears the end. Completely full spools are awkward to replace in the cans without damaging the film, and where necessary the last "part" of the film should be removed and placed upon a separate spool.

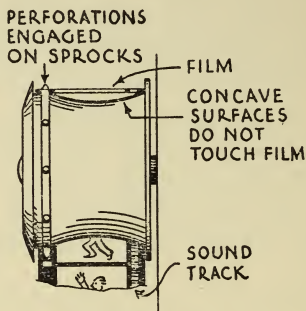


Fig. 15

A 16-mm. 8-PICTURE SPROCKET WHEEL (SOUND)

Another item of equal importance in film care is the replacement of worn sprockets before they begin to damage the perforations. On some silent projectors it is possible to reverse the sprocket-wheels so that both sides are given equal wear, but this should not be attempted on sound projectors other than 9.5 and 35-mm. models. And neither, of course, should it be tried on those modern 16-mm. silent machines which have single-row sprockets.

Besides tearing perforations, badly worn sprockets may also cause a degree of unsteadiness in both sound and picture reproduction. Intermittent sprockets, and constant-speed sprockets in or adjacent to the sound-head, must especially be always in perfect condition.

Films may also be protected by sticking down the end with a piece of adhesive plaster, as this will prevent them from loosening when in transit or not in use. A better idea, however, is the use of protective tapes which completely encircle the spool and

are kept in position by a piece of string, which is obviously better than sticking anything on the film itself.

Most film libraries prefer you to return the films just as they are when taken off the projector, as they rewind them themselves when examining them. However, many projectionists use their own special spools for the take-up, with the result that the films are automatically rewound when replaced on the original spools belonging to the library. But in this case the fault lies, perhaps, with the library. If they want the films returned without them being rewound then they must supply the films on spools which are in perfect order, and not so scratched or bent that the operator prefers to use his own instead. The operator could then use the library's spools during projection, except, of course, for the first reel, because this one will have to be rewound twice in order to get it the right way round for the library's checking staff.

Film Cement

Films are joined together by using a special film-cement, for non-flam films cannot be joined together with anything else. Various brands of film cement are available in the shops, and according to J. P. J. Chapman, in the "Proceedings of the B.K.S. Sub-standard Division," the ideal cement for non-flam films should consist of the following formula:—Acetone, 20 cc.; Chloroform, 4 cc.; Glacial Acetic Acid, 2 cc.; into which should be dissolved 2in. of new 16-mm. base. The cement should be kept in a glass stoppered bottle—not metal.

Film-cement will deteriorate if exposed to the air, and the stopper should always be replaced immediately after use. The cement may also be inflammable, but this is only one of the reasons why it is inadvisable to smoke when handling films.

Splicers

There is quite a variety of splicers on the market to-day, and many may be purchased already attached to a rewinding board.

A good splicer should enable the film to be held in the correct position for joining, and there should be a cutting device and a scraper for removing the emulsion, and also a press for holding down the join until the cement has done its work. In all cases

the emulsion must be removed first, preferably by gentle scraping, and taking care not to damage the perforations. The emulsion dust should then be removed by blowing and the cement applied, for which a camel-hair brush should be used. The glass rod which some manufacturers supply with their film-cement is not very practical, chiefly because it does not allow the user to control the exact amount of cement required for making a perfect join. A large drop from the glass rod will immediately spread, and because of its softening effect on the film, may result in the latter actually joining with the surface of the press, thereby making it necessary for the film to be pulled from the press after making the join.

However, the correct method for making a join will depend on the type of splicer being used, but in every case the result must be a perfect join. Nearly perfect won't do at all.

A good join is one in which the film is actually welded together, for the cement so softens the film that the ends are united into one piece. They do not merely stick together.

When choosing a splicer it is best to get one with an over-all length of at least 4 ins. and having at least three locating pins spaced on each half of the press. If only two pins are used there will be a possibility of the film moving, and at least three pins should be engaged if the film is to be correctly aligned. Also, choose a splicer with a perfectly smooth and rustproof surface, and one which may easily be cleaned without having to take it to pieces. But the best, of course, is the type on which it is only necessary to follow the maker's instructions in order to make the perfect join.

When joining sound-films you must not forget to paint over the sound track when you remove the film from the splicer, for the act of scraping usually removes everything but the colourless base of the film itself, and if the exciter rays are allowed to pass through a clear spot on the sound track at the join you will get a "plop" from the loud-speaker. The sound track is best painted with the same kind of black dye used for retouching photographs, and for this job is far better than Indian ink, as the latter tends to flake off after a time. But care must be taken not to allow the paint or ink to spoil the sound track on either side of the join.

If a faint plop can still be heard, even though you are sure

that no light can pass through the sound track where you have painted the join, it will be because the thickness of the join itself is actually lifting the film from its usual contact with the sound-drum or roller, and thus permits a brief flash of incidental light to reach the P.E.C. This can be prevented by screening any light from your sound-head and, perhaps, by making a better join next time.

Preventing Damage

Dirt and oil are the arch-enemies of film, but also included in this category are the careless operators—the gentlemen responsible for film mutilation.

Films may be mutilated by careless splicing, loss of loop in projection, careless rewinding, bent spools, worn sprockets and a host of other ways, but in every case the mutilation can be prevented by a well-trained operator using a little common sense and a great amount of care.

If a loop is lost in projection the motor must be stopped at once, otherwise the film will be so damaged that a large section may have to be scrapped.

In some cases the film may ride off the sprockets, and if this happens the sprocket-teeth may punch fresh holes between the perforations in the film. Film which has been interpunched in this manner cannot be handled properly by the smoothing system, and results in sound which has a “wavering” quality. Never try to save the show by trying to push the film back onto the sprocket-wheel—save the film instead; stop the motor, re-engage the perforations with the sprockets, and then restart. Unless the film is your own, you must put its care before everything else, even if you have to stop the show, but this should never be necessary if you always lace the film correctly and keep your projector spotlessly clean and in good order.

Some film libraries, worried over the amount of mutilation to their films, have introduced a system whereby the intending borrower must first prove that his projector is sufficiently sound and faultless before using their films. For this purpose they are sending out test films which have to be run through the projector and then returned to the library for examination by their experts, who look for scratches and other signs of wear and strain.

The examiners at one film library recently informed a new client that "We have carefully examined the test film . . . and suggest that you carefully service the whole projector!"

If the test film is returned in perfect condition the client is then allowed to join the library. Even so, the films are always examined on return, and at the first sign of damage the client is informed that he must service his projector before he can have any more films, and not until his machine has been given the O.K. will he be placed on the hiring-list again. The system has much to be said in its favour, for not only does it directly prevent mutilation, it also helps to educate the careless operator.

All of which is meant as a warning—a warning to look after the films in your care and at all times to handle them with the greatest of care.

Splicing a Film

In the following instructions, it is assumed that the operator is in possession of a splicer fitted with the usual number of working parts. These are—a flap or other device for holding one or both parts of the film in position, a cutting edge or edges, and an attached but moveable scraper.

1. Clean the splicer, the cement brush, and the table or bench on which you are working. Loosen the stopper of the film-cement bottle, but do not remove it until you are about to use the cement.

2. Place the film in the splicer with the emulsion (dull) side up, engage the perforations with the locating pins, and close the flap or other device which holds the film in place.

3. Next, snap down the cutting edge(s), but before proceeding make sure that both ends of the film are cleanly cut from edge to edge. (Many splicers are designed so that both ends of the film may be inserted and cut at the same time, and also allow one part of the film to be lifted clear in its holder while you carry out the next operation.)

4. The next thing is to remove the emulsion by scraping, but do it gently and smoothly, and without scraping the film right through. The scraping finished, lift the scraper clear and remove the emulsion dust by blowing. (Some people advocate moistening the exposed edge of the film before scraping it, which will help if your scraper is not so efficient as it should be. Wipe the film before proceeding.)

5. Apply the film-cement over the part you have scraped—it should be just wetted, but not flooded or merely moistened. Now place the other part of the film over the scraped edge and ensure that both parts of the film are correctly aligned. Then apply pressure over the join for about ten seconds. Do not forget to replace the stopper in the bottle, otherwise the cement will deteriorate before its time. Wipe your fingers before proceeding.

6. Remove the film from the splicer by holding the lower part only, and hold the join in place with a finger while you disengage the perforations.

7. “Bloop” the now transparent part of the sound-track where you have made the join, by applying a black dye, or a dab of thin quick-drying black paint. (Indian ink will do, but will not last.) Do not spoil the sound-track on either side of the join.

8. As a finishing touch, you may now lightly wipe across the actual edges of the joined film with the point of your cement brush. This will give the join a smooth exterior.

Examining the Programme

Immediately the films are received from the library, give each of them at least a cursory examination before attempting to use them. Count the number of reels, ensure that each is indeed a part of the right film, and check all the leaders, etc. And do not wait until the end of the first performance before finding out whether there is a Queen Trailer* or not attached to the end of the last spool of film.

Should you discover any form of damage, report it at once to the library, and make your report *before* using the film. If the film is badly damaged, return it to the library as being unacceptable—remember that badly damaged films cause stop-pages during projection which cause *further* damage to the film.

Holding the spool of film against a strong light will enable you to see most of the joins and also if the film is interpunched. Interpunched films are “spongy” and cannot be wound very tightly upon the spool.

To check whether a film is wound the correct way for projecting, first place the spool on the spool-arm in the usual way, standing facing the lens with your back to the screen, and then lift the end of the film straight up from the spool. If the titles

*The National Anthem.

can then be read as they should appear on the screen then the film has been correctly rewound.

Loop and Cycle Films

A cycle film is an endless band of film up to 15 feet in length which is used for screening continuous repetition of some particular movement, such as the working of a piston or a movement in basket weaving, etc.

A loop film is similar to a cycle film in that its ends are joined together, but it may be up to 400 feet in length and repeat any number of movements or perhaps a complete story. Both are valuable aids in education and publicity. With these films, a special apparatus known as a loop absorber may be used in conjunction with almost any kind of cine projector.

Educational film libraries supply loop and cycle films on a wide range of subjects.

Testing For Damage Caused to Films

To test the degree of damage caused to films by any particular projector, make a loop of new blank film 36 inches in length and run it through the projector 500 times. This is one of the standard tests for projector efficiency, but a less stringent test will quickly show how much damage is being caused to the perforations, and by scratches, etc. Usually, the damage caused to the loop after about 50 runs is quite sufficient to jar the most complacent of operators.

Test-Films for Lens Definition

Probably the best type of test film for proving the degree of sharpness obtainable with a given lens is that which screens an image of what appears to be a sheet of graph paper. The picture, showing nothing but a mass of very fine lines, is brought to as fine a focus as possible in the centre of the screen; the edges of the picture may then be examined to note the degree of falling off in focus.

The characteristic of soft focus at the edges of the picture depends, of course, on the quality of the lens, but because of the mere existence of this characteristic, it is important for the projectionist to aim at achieving as fine a focus as possible at

a point midway between the centre of the screen and the edges. But this is something which need not worry the operator who is screening only a very small picture—it will be quite sufficient if he obtains a finely-focussed centre. It is only on large screens that a soft focus may be seen at the edges when using “average” lenses.

Test-Films for Picture Steadiness

Any film which contains a lengthy “still” sequence and which is also in perfect condition may be used to test the steadiness imparted to the film by the gate tension. Compare the picture with the perfectly-still edge of the screen and note the degree of jumpiness. If you are positive that the film is perfect and the picture jumps, then the fault is mechanical and is caused either by incorrect gate-tension or perhaps by some fault in the intermittent mechanism. A common practice is to put the film out of rack* and observe the lower frame line for steadiness.

Gate-tension should normally be increased until the jumpiness stops and the picture remains perfectly steady, but if such adjustments make no material difference the tension should, of course, be at once slackened off again. If the jumpiness persists, the cause may be either mechanical or due to offset printing of the frame-line in relation to the perforations. But how can the operator tell whether the film or the projector is at fault? The answer is found by making use of one of the new picture-test films, which may be hired from one or two of the specialist film libraries.

These films give a perfectly still image of a number of dots, each of which is actually a small hole punched in the picture area. The holes are made at the same time as the perforations and there is no possibility of them “wandering” as subsequent photographic images may. Any unsteadiness of the dots in relation to the screen itself will prove conclusively that the fault lies with the projector. The trouble could be caused by worn claws or cam, or perhaps by a worn cross and sprocket, etc.

The Buzz Track

A special test-film for correct location of the scanning-beam across the sound-track is also available in the 16-mm. gauge.

This film has a blank sound-track, but on either side of the

*By means of the framing control.

sound-track area is a narrow strip carrying recorded sound-signals. If the exciter-beam is correctly located at dead centre, no sound will be heard from the loudspeaker, but if it is offset, the sound then heard will indicate on which side of the sound-track the scanning beam is overlapping, and adjustments to the sound-optics can then be made accordingly.

If the sound heard from the buzz track is low pitched (300 cycles) the beam is overlapping on the picture side of the track ; if high pitched (1,000 cycles) it is overlapping on the outer-edge side.

The adjustment which has to be made to align the sound-track directly under the scanning-beam entails, usually, the tightening or slackening of a screw holding a guide-roller (in some cases the sound-drum) so that the film is then moved bodily into the correct position.

Constant Frequency Test-Films

These are used to test accuracy of focus of the scanning beam and are a great help to the technician in locating and correcting the causes of flutter and wow. When in use they provide a long steady note of certain frequencies, and any variation in the speed of the film through the sound-head is at once made obvious to the listener.

The projectionist usually has to rely on his sense of hearing alone when lining-up the sound optics, but the technician, besides using such test-films as the constant-frequency type, also makes use of a number of instruments whereby to measure the sound and its quality. The gliding-frequency test-film, for instance, produces a steady note which slowly rises in scale until the point is reached when the amplifier is no longer able to reproduce it without distortion; the technician then looks at one of his meters and discovers, perhaps, that the amplifier isn't so hot on sound above 8,000 cycles, and other meters will tell him why and where to look for a possible fault.

But are these films of any use to the operator who is not a technician? Yes, they can be very useful indeed, and almost anyone using them for the first time will find them of value and simple to use.

Frequency test-films are available as single, multi or gliding frequency test-films in the 16-mm. gauge.

The Snake Track

This particular test-film is designed to show whether or not the scanning-beam is of even intensity. The sound-signal, which produces a constant even note, is printed in a narrow strip along one-third of the sound-track area. This narrow strip weaves from side to side of the sound-track area along the full length of the film.

When projected, any unevenness of illumination would be at once noticeable by an alternating drop in volume, whilst an even note from the loudspeaker would indicate that the scanning-beam was of even brightness across the sound-track.

Sound and Picture Test-Films

Providing the projectionist with an opportunity of making a large number of tests, these films contain half-a-dozen or more excerpts from well-known feature films, plus sections of speech, piano-music and a number of other sounds, the whole covering a very wide range of different types of sound and picture. Both variable-area and variable-density recording may be in the same test-film.

Test-films have now been standardised and readers requiring the complete descriptive standard may send for British Standard No. 1488 of 1949, Test-films for 16-mm. Cinematograph Projectors (2/-) from the British Standards Institution, 24/28, Victoria-street, London, S.W.1.

Repairing Damaged Films

If two or more consecutive perforations are torn, the smallest possible section should be cut out and a careful splice made. It is not usually necessary to cut and make a join in the case of a single perforation being torn unless the film is to be used on a projector fitted with a single claw. Badly torn sections of film should, as a rule, always be removed from the film before it is used, but this does not apply to single blistered frames or other minor forms of damage, unless the particular type of damage is likely to cause a stoppage during projection.

If a damaged film will pass safely through the projector, then there is no need to cut the film and make a join. And that can be your guiding rule.

Interpunching of the film, which is probably the worst form

of damage because of the difficulty of repairing it, often occurs unnoticed by the careless operator.

If the film is punched (by the sprockets) across the picture area, then the film will probably become worthless, as there is nothing one can do when once the picture is badly marred.

Interpunching between perforations, however, may be dealt with by using the same method adopted for servicing buckled and creased film. This consists of ironing the film! The iron is made just hot and the film covered by a sheet of thick brown paper before using it. On principle, the author cannot advocate this method, but as there does not seem to be a better way of removing creases and interpunching, well . . (But be careful not to make the iron too hot!)

Is it possible to remove scratches from film? No, but their effect can be minimised as far as the picture is concerned. Nothing can be done about a badly scratched sound-track. A number of companies in the film renovating business will offer to remove the scratches for you. Actually, all dirt is removed from the scratches so that they are then less noticeable, after which the film is then waxed and the scratches thus filled with a transparent medium. Note that the poor effects which are caused by scratches are mostly due to the dirt held in them—those “tram-lines” which you see on the screen are made of dirt.

There is no reason why amateurs and others should not take advantage of the services mentioned above—keeping the film rewaxed lessens the chance of scratches penetrating to the emulsion and spoiling the picture. Most film libraries give their films some such treatment at regular intervals, which helps to keep them in circulation as long as possible.

Greater care of films by the operators will mean that fewer costly replacements have to be made by the renters, which will, or should, result in a gradual reduction in hire charge. In other words, it will be to your material advantage to look after the films you hire or borrow.

6

Screens

THERE ARE FIVE main types of screen surfaces, each of which has its own characteristics and different method of cleaning. These are the Mat-white, Silver, Beaded, Translucent, and the Perforated screens.

The White Screen

The plain white screen is the most popular with operators who have to use it in halls of all shapes and sizes. It reflects the light evenly, and has a very narrow side-angle of distortion not noticeable by anyone unless they are sitting far to one side of the screen and well forward. This screen is best treated by repainting it with an even coating of Titanium White, which is far superior to the ordinary white lead paint.

The Silver Screen

Silver screens present an excellent picture to those seated in the centre of the hall, but as one moves to either side a remarkable decrease in brilliancy occurs, and as the angle of distortion is most pronounced, this type of screen is only suitable for halls which are long and narrow, or where the audience can be bunched together in the centre. The surface texture of these screens varies according to the make, and only specially recommended paint should be used.

Glass-Beaded Screens

Beaded screens throw back a very brilliant reflection about the width of the screen, and the remainder of the reflection

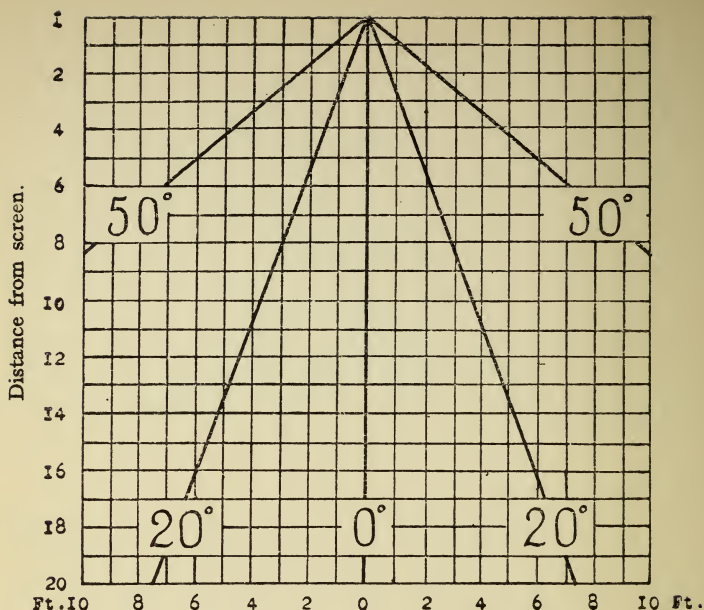


Fig. 16

Most favourable seating area for glass-beaded screens:—20°
 , , , , , mat white , :—50°

does not fall off in brilliancy to the same extent as the silver screen. The angle of distortion is also smaller.

For the best results the audience should be seated in an area roughly fan-shaped, with the outer seats on a line little more than 20° from the centre of the hall.

The beaded screen is actually covered with a surface of minute particles of glass, and in theory, each particle is a perfect sphere, the inner surface of which acts in the manner of an aspherical reflector. This type of screen must never be wiped or washed, and should always be returned to the manufacturer (or agent) for reconditioning.

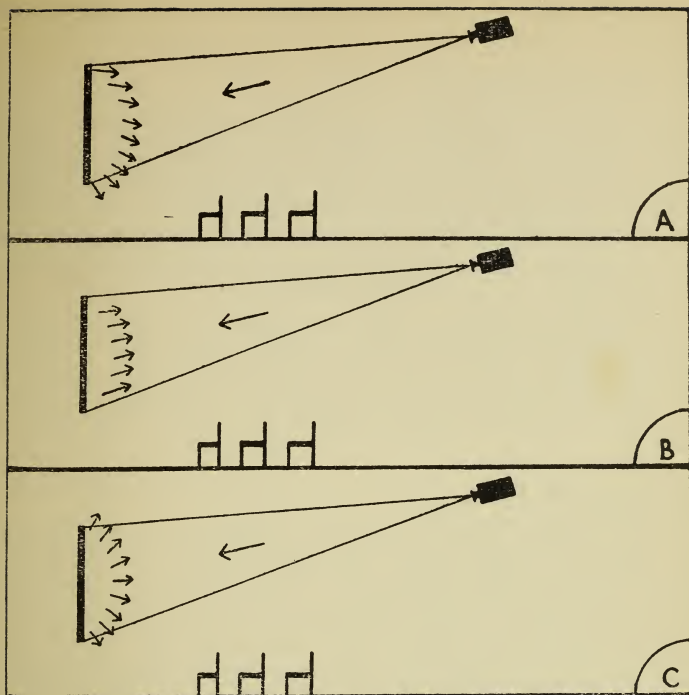


Fig. 17

THE BEST SCREEN IS SOMETIMES THE WORST TO USE FOR A PARTICULAR HALL

Do you wish to project from a high balcony? The characteristic reflections from the various screen surfaces are indicated by the small arrows in the above illustration. These are: A—Silver. B—Beaded. C—White. Note that B will give the audience a poor picture, but that it will probably appear to be quite good to the projectionist up in the balcony.

Translucent Screens

This type gives the most brilliant picture of all, but only by having the projector behind the screen. They are of little use for front projection. Many of these screens are now made of a plastic material which may be washed, but here again you must make sure that it is safe to do so by asking the manufac-

turer. The angle of distortion is usually small, but depends on the type of material used.

The Perforated Screen

Perforated screens may be made from quite a number of different materials, but are usually of a woven cloth specially treated. The only advantage of the perforated screen is that the loud-speaker may be placed behind it, so that the audience may hear the sound direct from the screen. The sound may be impaired, however, if the perforations are allowed to fill up with dust and dirt.

The perforated screen "may sometimes be cleaned with a vacuum-cleaner," but this is seldom successful after the third or fourth time, as the weave tends to lose its geometrical structure. It is best to have the screen serviced by a firm specialising in this work.

The Screen to Choose

For the 16-mm. operator, a screen which can be erected without assistance is the ideal, and many kinds of self-erecting screens may now be purchased. In one example, the screen is rolled up within a long wooden box, and is erected merely by taking hold of the top of the screen and lifting it up—the screen remaining upright by means of spring-tensioned folding supports and the roller acting in the same manner as the familiar roller-blind.

Other screens may be of the type which are stretched by wooden frames and then hung or stood in position, but frames are liable to warp or bend after being in use for a time, and when this happens they should be changed to prevent damage to the screen by having its surface pulled out of shape.

When the screen is not in use it must be protected from both dirt and damp by the use of suitable covers. Screens are often made dirty by fitting them together on the floor, so always ask for assistance to keep the screen away from it, and remember that the back of the screen will convey dirt to the front surface when rolled up after use.

The correct screen can be selected to suit the size of audience and conditions from the table on page 80, which gives the dispersion of the various surfaces.

Angle from the Normal	Proportion of Light Reflected (Assuming 100% from Beaded at Normal)		
	Beaded	Silver	White
0°	100%	84%	35%
20°	38%	42%	32%
50°	16%	7%	20%

Chart reproduced by courtesy of Neville Brown & Co., Ltd., makers of "Cinepro" Screens.

Choice of screen will depend on the operator's particular needs, but care should be taken to get one which is sufficiently strong and with a clean and even surface. Beaded screens should be examined under exhibiting conditions, and with the light from a projector focussed full upon the surface. Directional screens cannot be examined properly in daylight.

The size of the screen required will depend on the projector lamp's wattage, the length of the throw, and the focal length of the projection lens.

It should be noted that the brightness of the picture depends on the amount of reflection from the screen, and as this varies according to the type of surface, we may judge a screen by the direction and strength of the reflections.

Screens which reflect the light evenly are known as non-directional, and in this category the matt-white and translucent screens are placed respectively. The perforated screen is also non-directional, though it should be mentioned that quite a few of these screens are of poor quality, and like the translucent types, may be directional when they should be otherwise.

On the other hand the beaded and silver screens are definitely directional, and with them there is a marked falling-off in brightness as the angle of viewing becomes more acute, and in some cases the picture is even seen distorted.

In choosing a screen, therefore, you must take into consideration the area of good visibility, the area of poor visibility, and the angle of distortion, though the latter need not worry you if your hall is long and narrow.

For daylight projection the translucent screen should be used, but in this case the brightness of the picture will depend on the amount of daylight you can keep away from the screen. This screen is only used for rear projection, and with the aid of a mirror is ideal for use in schools or anywhere where space is limited. Its use also allows the teacher to keep his place at the front of the class and yet control the projector at the same time. The correct layout for front and rear projection is described in the chapter on Exhibiting and Layout.

A white wall may also be used as a screen, and even the ceiling when the show is for hospital patients lying in bed.

Testing Screen Brightness

There are two kinds of light-meters used by projectionists—those which measure the light from the lamp and those which measure light reflected from the screen.

Light can, of course, be measured in many ways, but the basic unit for all measurements is candle-power. The power of a lamp may be described in candle-power, or in wattage, which is an electrical unit. But at the moment we are concerned only with light measurements. And the first thing to get straight is the difference between lumens and lamberts.

The efficiency of a lamp is described as being so-many lumens per watt, and by using an appropriate meter we can measure the number of lumens emitted from the lamp.

Measuring lumens, however, is not very practical for the projectionist, and for various other reasons he uses a meter marked in foot-candles. Known as a photometer, it can be held in front of different portions of the screen to measure the amount of light received from the lamp.

The photometer may contain a photo-electric cell, or perhaps a plate on which is coated a light-sensitive substance which, when exposed to light, will produce a small current capable of actuating a needle against a graduated scale.

Holding the meter in front of the centre of the screen will give you the highest reading, but as this may bear no relation to the amount of light reaching the edges of the screen, the meter should be moved about over the screen-surface and a number of readings taken. The average reading obtained is then that of the

mean distribution of light, and this is the reading used when considering standards of efficiency for the projectionist to maintain.

You must expect, however, to find the mean distribution-figure lower than the centre reading, especially if there happens to be a bright spot in the centre of the screen or considerable falling-off in brightness at the edges.

A standard of 8 foot-candles has been decided on as the average mat-screen reading for 16-mm. professional exhibiting.

So far we have considered only the light falling upon a surface and the subsequent measurement of that surface in foot-candles. Such measurements are not much help to the amateur, of course, for usually he tries to get as bright a picture as possible with lamps of low power.

Under the exacting conditions of professional exhibiting, however, the photometer is an invaluable aid in indicating, besides screen brightness, the possible falling-off in efficiency of a screen's surface, which occurs over such a lengthy period of time that the deterioration may develop unnoticed by the ever-present operator.

Every screen reflects and distributes light over an area the size of which depends on the type and texture of its surface. This light, which is light reflected from the screen into the eyes of the audience, can also be measured by means of a photometer—this time marked in foot-lamberts.

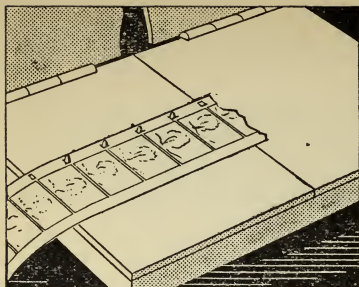
The meter is held facing the screen when standing in the middle of the seating area for a centre-reading, and afterwards held (always with it pointing at the screen) in various parts of the seating-area for readings necessary to arrive at an average figure. And now we come to an important difference between measuring screen-brightness and measuring screen reflectivity.

When we hold a meter against the screen we are measuring the light received from the lamp and we use such measurements to ensure that sufficient even light is reaching the screen. But when we direct the meter at the screen, we are measuring the light received by the audience, and an average reading in this case is of little practical value. Instead, a standard reading should be decided upon for that section of the seating-area which has the (normally) lowest reading, and subsequent readings for that section should never be allowed to fall far below that

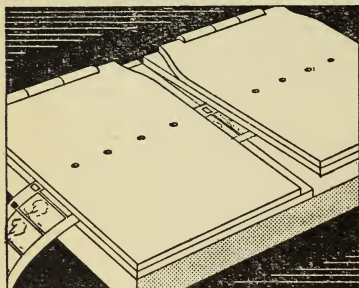
figure. The standard reading may be obtained by projecting with a new lamp, spotless optical-system, and with the auditorium clear of smoke.

All standards set by the 16-mm. exhibitor as a guide to his own future efficiency must likewise be arranged and set under the most perfect of conditions. The time to measure, for instance, the reflective properties of a screen is when it is still new and as efficient as it ever will be.

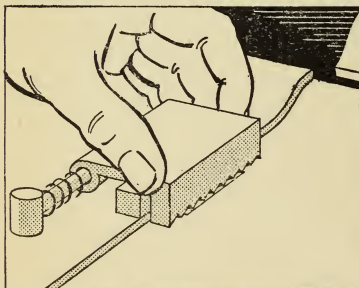
FOUR TIPS ON FILM-SPLICING



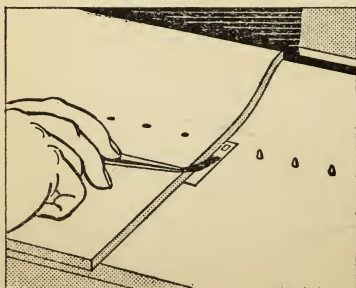
1 Always ensure that the film perforations are engaged with the locating-pins, and that there is no movement of the film when the flap is brought into position.



2 Snap down the splicer cutting edge in one easy movement. Check the smoothness of the cut film with your fingers.



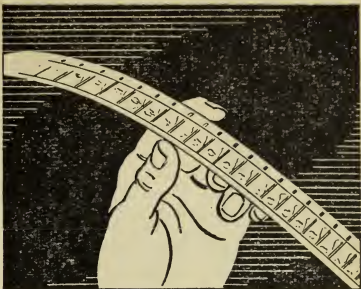
3 Scrape away the emulsion gently and evenly, and do not tear the film. Remove the emulsion dust by blowing.



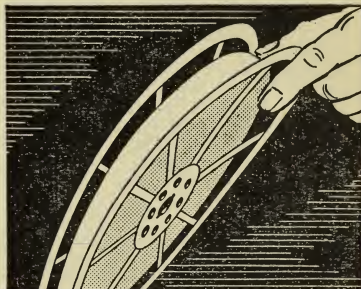
4 Apply a small amount of film cement with a brush. Align both sections of the film and quickly apply pressure. After 10 seconds, examine and test the join.

FOUR TIPS ON FILM CARE

- 1** Handle films only by their edges and with clean dry hands.



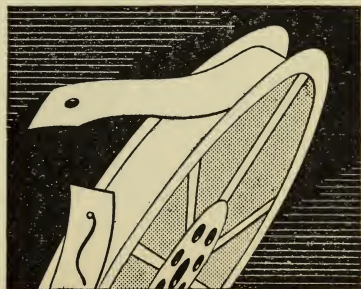
- 2** Use clean, straight spools, and always lift loaded spools by the finger-holes, **not** by their edges (see fig. 2, page 89).



- 3** Rewind slowly and keep the film taut. Wind the film with a uniform compactness. Keep the spool-arms correctly aligned and rigid.



- 4** Prevent chafing of the film edge during transport by wrapping tape around the spool. Paper tape is clean and you can write on it details about the film.



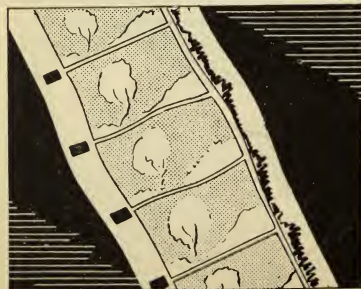
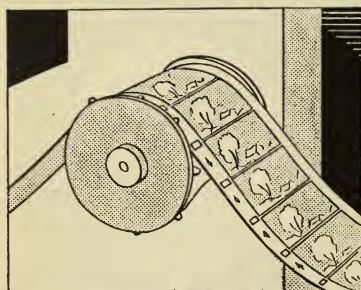
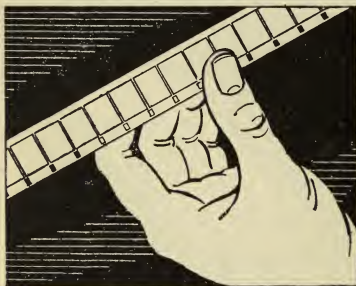
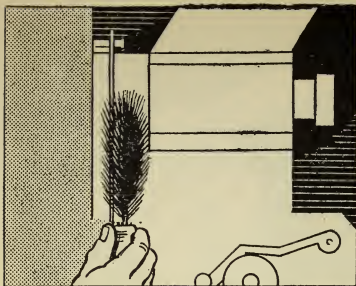
FOUR TIPS ON PREVENTING FILM DAMAGE

1 Dirt, dust and heat damage film. Clean the projector before every show, and make sure the whole of the film-track is scrupulously clean.

2 Mechanical defects damage the film. Watch for them during projection. A thumb and finger on the film as it runs onto the take-up will tell you if the film is being damaged, and if the take-up is faulty.

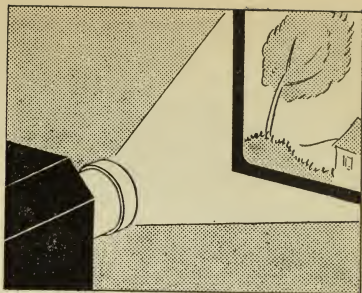
3 Interpunching of the film is caused by it riding off the sprockets. Test the sprocket-guards, and check the lacing of the film before switching on.

4 Heat and dryness will warp and shrink the film. There is no cure for films damaged in this way. Suitable storage conditions are the best preventative.

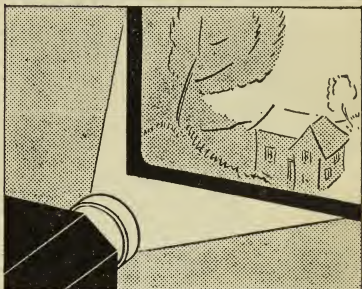


FOUR TIPS ON PROJECTION

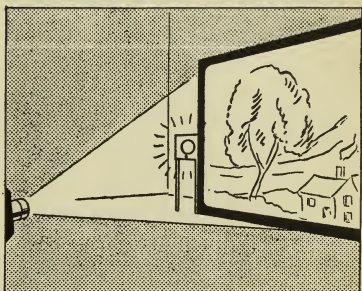
1 Check the focus throughout every film show. A correctly focussed picture is one of the essentials of projection.



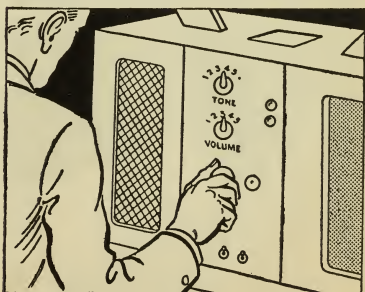
2 The screen must be taut, even, and clean and at just the right height for comfortable viewing. Provide ample illumination, by ensuring correct voltage, lamp wattage and clean optical system.



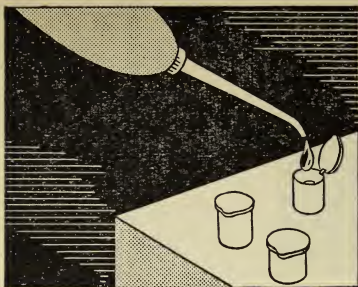
3 Volume and tone must be constantly checked and the output must suit the requirements of the audience. The best position for the speaker is where you get the best results.



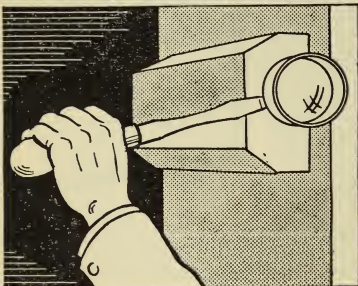
4 At all times keep strict control of focusing, illumination, framing, film-speed, sound, audience, hall lights and exits.



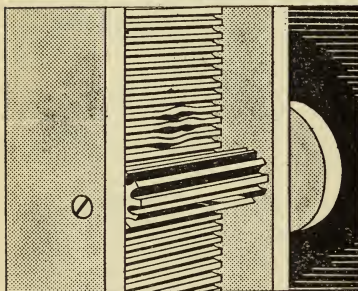
FOUR TIPS ON EQUIPMENT CARE



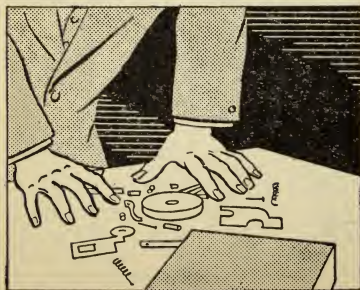
1 Oiling (and greasing) must never be skimped or forgotten. Apply the correct number of drops to the right oiling-point at the right time, in accordance with manufacturer's instructions.



2 When servicing projectors never use force; much of the mechanism is extremely fragile and adjusted to precise limits.



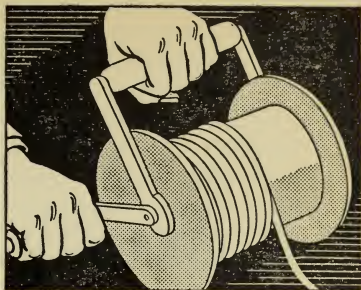
3 Faults? Don't let them happen. Keep looking for them at all times and prevent them breeding.



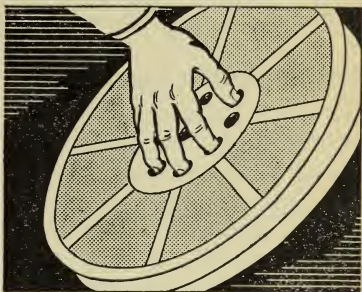
4 Don't experiment! A projector contains about 1,400 different parts and when in doubt a skilled service engineer should be consulted.

FOUR TIPS ON STORAGE

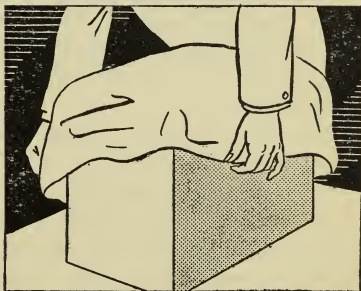
1 After a show, switch off at the mains and wind up the cables so that they do not develop kinks. A proper cable-drum is ideal.



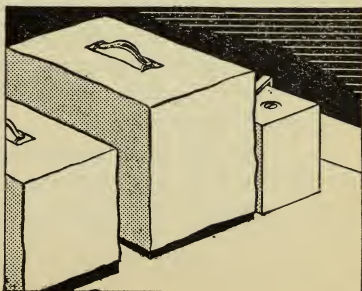
2 Return all films to their proper cans, and don't forget the leaders you may have removed when joining up the programme.



3 When packing the equipment follow the manufacturer's instructions and always remember to replace the dust covers.



4 And lastly, store the equipment in a place where it can remain in a cool dry atmosphere, and where it will not be in the way of other people.



Exhibiting and Layout

Setting up the Equipment

BRITAIN'S FIRST *pecially built* 16-mm. cinema is the Cameo at Skegness, officially opened by the Chairman of the Council on Easter Saturday, 1947. This was a red-letter day for showmen and amateurs alike, for the opening portrayed the latest and greatest triumph of those who had worked so hard to make the 16-mm. machine a "truly professional model."

The Cameo's auditorium measures 81' in length by 26' wide, and has comfortable seating accommodation for 368 people, but the most unusual feature is the provision of sliding doors—a type of exit never seen nor permitted in standard 35-mm. cinemas in Britain.

A 9' 6" perforated screen is used, with a length of throw approximately 75 feet.

The ceiling is perfectly flat, and in order to minimise the echo from its surface it has been specially sprayed with a coating of granulated cork. Visibility is also good, for the bottom of the screen is well above the heads of the audience. Within the operating box the floor has been raised about three feet, thus allowing ample height for projection and obviating the possibility of anyone's head getting in the way of the picture, a principle which should be followed by every 16-mm. operator when setting up his equipment.

In setting up your equipment then, you must see that the bottom of the screen is at least four feet above the heads of the seated audience, but on the other hand it must not be too high, nor cause the people sitting in the front rows to view the screen at an uncomfortable angle. In some cases the screen may not

be as high as you would like it, especially in rooms or halls with a very low ceiling or where supporting beams would interfere with the top of the picture, but this sort of thing need not worry you if you have another lens with a longer focal length. Your picture would then be smaller, but being smaller it should then be possible to clear the heads of your audience. The bottom of the screened picture, even if it is only showing on the top half of the screen, must be above the heads of the audience. (Fig. 18).

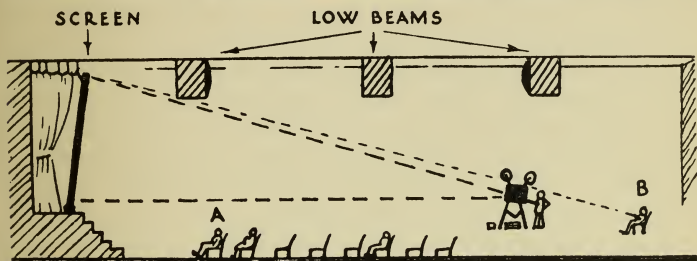


Fig. 18

Very low beams? Then move the projector forward, and if necessary, tilt the screen as well. Note that in the diagram Mr. B. can still see the top of the screen as well as Mr. A, in spite of the fact that the screen is higher than the beams. But never have part of the audience behind the projector if you can arrange it otherwise.

If a smaller picture is necessary, and you have no other lens than the one on the projector, you must bring the projector forward, for by shortening the length of throw you correspondingly shorten the width of the picture. But always fill the screen if you can, and if this is not possible, the use of black drapes, by covering the rest of the screen, will considerably improve your picture and make it easier to look at. Professional mobile operators now carry these drapes as part of their equipment, and they are always used whenever the length of the throw prevents the screen from being completely filled by the picture.

The screen must be perfectly square to the audience, absolutely rigid, and so fixed that it cannot possibly sway about, and if there is a door behind it you must take care that it is closed throughout the performance, as draughts may ripple the surface and distort the picture.

If the screen is set well back before a large expanse of polished

flooring the latter should be covered, not only to prevent reflections from the screen and light from elsewhere, but also to prevent any possible reflection of sound from the loud-speaker. Reflected sound, of course, is echo, and any hard or smooth surface will produce it. All such surfaces must therefore be covered, especially those in front of the screen and near the loud-speaker.

The loud-speaker should be placed as near to the screen as possible and preferably half way up, to one side, and then slightly turned so that its front is square towards the opposite and far corner of the hall. It may then be tilted slightly downwards towards the centre of the audience, so as to "beam" those upper frequencies of sound which are directional, and which should not be lost if the quality of the sound is to be maintained. With a perforated screen, the speaker is placed behind, and preferably at dead centre.

If your loud-speaker has to be placed before a wall you should cover the back of the speaker or even the wall itself, as this will considerably lessen a very bad form of echo (backlash).

It is not correct to place your loud-speaker on top of a piano. The reason is that certain frequencies in sound will set the piano humming—the strings are set in vibratory motion and thus produce a new and unwanted sound, and this is something which must be avoided at all cost if you are hoping to put on a perfect show.

The position of the projector will depend on prevailing conditions, but whenever possible it should be placed as far back as it can go without resulting in a serious loss of light, which will naturally depend on the wattage of the projector lamp and the power supply.

Generally speaking, the projector should always be behind the audience, as the noise from the projector itself can be very distracting, but apart from this the operator should always try to seclude himself and his equipment. It is safer, lessens the chance of possible interference by inquisitive people, and makes for better showmanship.

Where there is a centre gangway the projector should be set up to one side of it, especially if the gangway is leading directly from the main exit. The average projector and its stand does not usually allow sufficient height for ample clearance of the

audience, and where possible they should be set upon a large table. Many operators prefer to project from a stage or platform, and in many village halls the platform is used as a ready-made operating box, the curtains being drawn to within a foot of each other or closed around a hoop, and through which the picture is projected onto the screen at the other end of the hall.

The Mobile Operator

The layout of the equipment will vary from hall to hall, and it should be remembered that in some a great amount of work will have to be done in preparation for the show. Mobile operators should therefore set out in good time, and if possible reach the hall at least one hour before starting time, and immediately report their arrival to the person in charge. It is quite possible that black-outs are missing from the windows, chairs have to be arranged or even collected from elsewhere and a number of other arrangements made before the operator can make a start on his own equipment. In such cases as this it will depend on the operator's own position and standing, which will determine whether or not he should have to do the work himself. It is no good arriving an hour before the show is due to start if there is an hour's work to be done in the hall first, but the moral, of course, is to see about it the day before.

The hour's grace before the show should be used for setting up the equipment, and carefully checking it for the correction of any faults. For public exhibitions even more time is wanted, and everything should be ready in time for the opening, in most cases about half an hour before starting time (Fig. 19).

After reporting his arrival, the operator should next check the voltage by looking at the meter, irrespective of the fact that he may already have been told what the voltage is. (But don't act as though you do not believe the person supplying the information. The point is, that it is the responsibility of the operator to make absolutely sure that the voltage is correct for his equipment.) The author was once told, most emphatically, that the mains supply was D.C., and having no reason to doubt his informant, he accordingly rigged up his rotary converter. However, the day before, the local electricity company had changed over to A.C., a fact which no one seemed to know

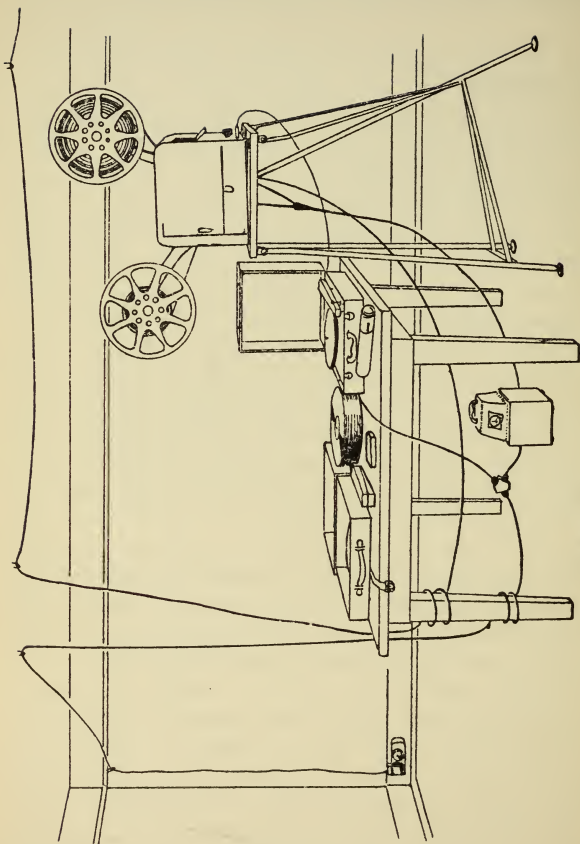


Fig. 19

"This is the author's favourite lay-out. Note that the cables are taken overhead and that there is little to be seen on the floor. You will also notice that the non-sync is connected to the mains cable before it reaches the transformer. This means that the voltage for the non-sync is different to that supplied for the projector. What do you think the voltages may be? And can you tell from the illustration whether the equipment is connected to A.C. or D.C.?"

anything about, and with the unfortunate result that the converter was partially damaged. Since then the author has always made a point of looking at the meter himself, and you are advised to follow suit and make the procedure a habit.

Even if your equipment is universal you must still make sure that the voltage is correct and of sufficient pressure, and that it is within the scope of your transformer tapings or resistance limits.

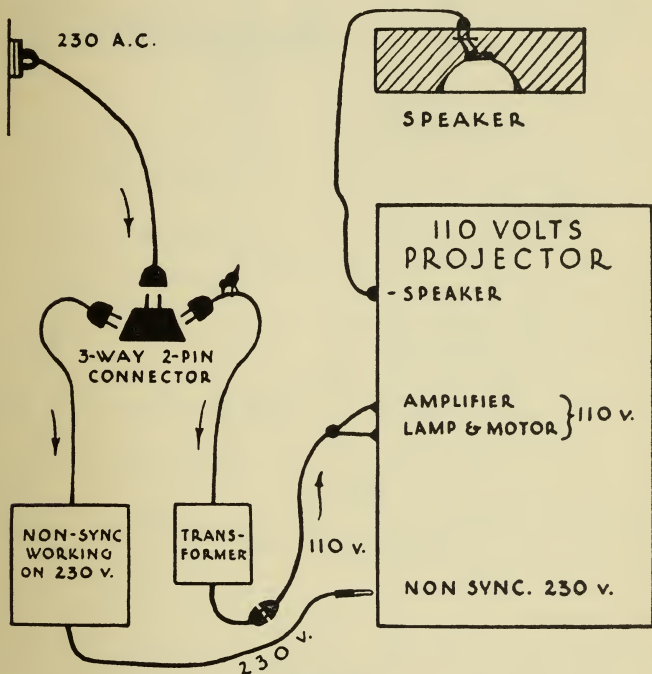


Fig. 20

Lay-out for connecting a 230-volt non-sync with a 110-volt projector (A.C. only).

Having satisfied yourself concerning the voltage the next thing to do is to decide on the best layout of your equipment. And in the case of very small halls or rooms only capable of seating a dozen or so, you may find that the usual method won't do, for the layout may have to be fitted in with the existing

layout of the furniture, or even to suit a room of unusual shape. In many cases the screen will have to be in a corner, but this has certain advantages, such as the longer throw when the projector is placed in the opposite corner. In all probability the

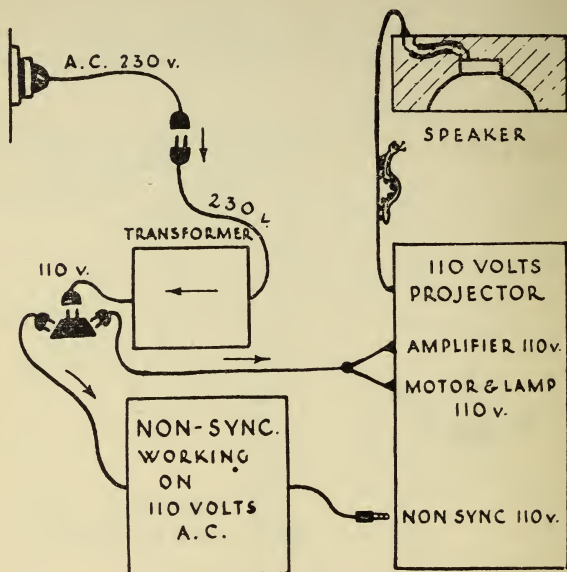


Fig. 21

Lay-out for connecting a 110-volt non-sync with a 110-volt projector (A.C. only).

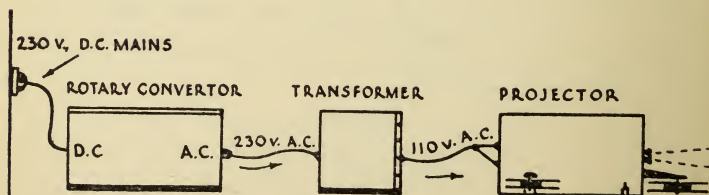


Fig 21a

Always make sure that you connect the D.C. supply to the D.C. end of the rotary converter. And when operating, you may have to use both the lamp and motor switches simultaneously, so look for this instruction in your manufacturer's "Instruction Book."

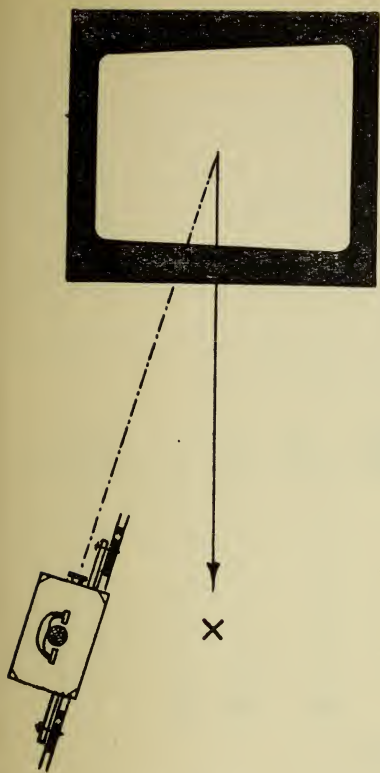


Fig. 22

This illustration shows the "key-stone" effect caused by not having the projector absolutely square and in line with the centre of the screen. The cross shows where the projector should be for a correctly shaped and focussed picture.

arrangement will allow you to get a few more seats into the room. The screen, of course, must be absolutely square to the projector, otherwise only one side of the picture will be in focus at a time. But however you place the equipment the result must always be the same:—

(a) Every member of the audience should have a clear view of the picture, and the picture itself should not be distorted or without sufficient brilliance.

(b) The size of the picture must be in proportion to the size of the room, and if possible, the screen should be filled. (But don't try to fill an 8' 6" screen in a room about 12' square!)

(c) The projector should be at the back of the audience and its noise prevented from distracting their attention. If there is no operating box nor any other room which may be used as such, upright screens should be placed in position around the projector.

(d) The room or hall should be in darkness, unless a special daylight screen is being used, but even this type of screen can be improved by darkening the room.

(e) Gangways and exits must be kept clear during the show.

(f) All cables must be so placed that no one can accidentally

or otherwise interfere with them. They should preferably be slung at least seven feet above the floor.

(g) The mains supply must be connected to a proper power-point, and never connected to the lighting circuit. If no power-point is available the mains cable should be connected to the fuse-box.

(h) If possible, the bottom of the picture should be 4' above the heads of the audience and the projector lens 6' above the floor.

The projector should not be brought within the seating area, except to clear the picture of shadows caused by low beams or other supports to the ceiling.

(i) The volume of the sound from the loud-speaker should be in proportion to the size of the hall or room.

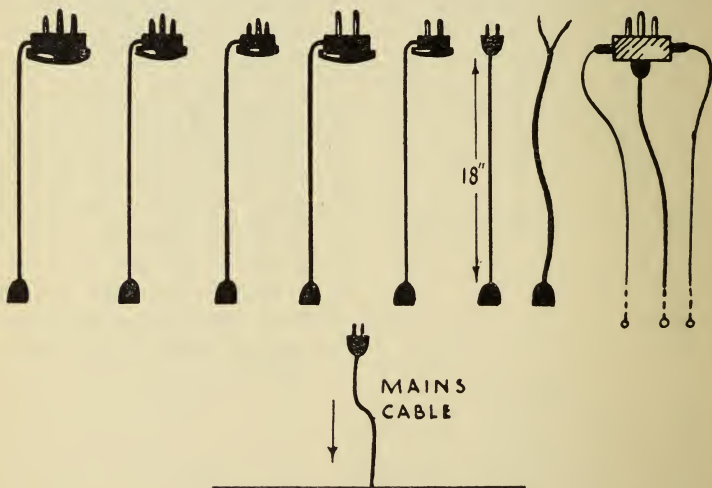


Fig. 23

"EVER-READY" CONNECTIONS FOR THE MOBILE PROJECTIONIST

Electrical engineers may frown on this idea, but it will certainly save you a lot of time and allow you to connect the proper plug without having to use a screw-driver. But take care to use 10-amp. flex connectors, 5-amp. ones may not be sufficiently strong.

(j) The loud-speaker should have sufficient height to clear any nearby obstructions, and unless the screen is a perforated

one, the speaker should be placed half-way up and to one side of the screen and as near to it as possible.

Rear Projection. For Schools

The reader has by now a fairly good idea how to go about the setting up of his equipment, but there yet remains the special layout required for rear projection.

You know, of course, that a mirror should be used in order to reverse the titles and wording appearing on the screen, and also that the screen must be of the translucent type.

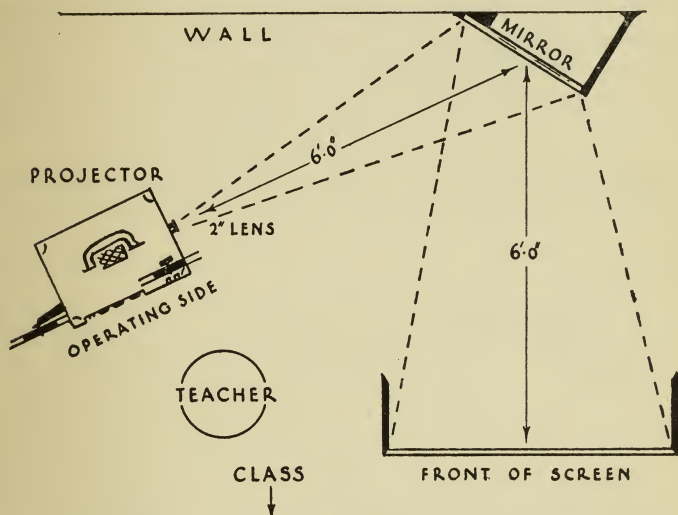


Fig. 24

LAY-OUT FOR REAR PROJECTION WITH A TRANSLUCENT SCREEN

The height of the centre of the screen and mirror must always match the height of the projection lens, and the centre of the mirror must be on a line with the centre of the screen. Note that in the illustration the teacher can operate the projector with his right hand and at the same time face the class. A "left-hand projector," such as the Carpenter or Natco, should be placed on the other side of the screen.

If we look at the illustration (Fig. 24) we find that the projector, mirror and screen form by their positions a rough triangle, and that all three are set at certain angles to each other

within the triangle. This "triangle of equipment" may be moved to any position in the room, providing, of course, that the relative positions of each part are not moved out of line with the others. The mirror naturally halves the length of the throw and, unless the mirror is a good one, the picture may be thrown slightly out of focus or perhaps distorted.

You must not use a mirror which distorts the reflection, and before using it you must see that it is thoroughly clean and polished.

In positioning the equipment, the height of the projector lens should be exactly the same as the height of the centre of the mirror and the centre of the screen. And the mirror must be set on a line at right angles to the screen's centre.

The figures given in the illustration are for the average layout, but should a larger screen be used the distance between the projector, mirror and screen will be correspondingly greater.

There is also a right and a wrong side to the translucent screen, but in most cases the rough side should be towards the audience.

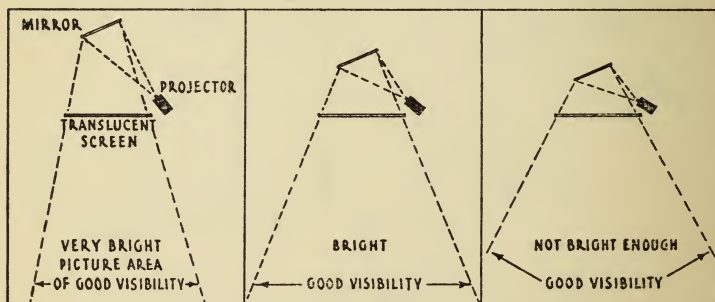


Fig. 25

REAR PROJECTION WITH MIRROR

Showing how the brightness of the picture and the width of the area of good visibility can be controlled by the length of the throw.

Tests carried out with a number of different types of translucent screens show that the area of good visibility corresponds to an area enclosed by lines drawn from the mirror to and beyond the edges of the screen. This is explained by the diagrams in Fig. 25. Note that the width of the area of good visibility also corresponds to the actual width of the projection-beam after

it has left the screen and spread out across the auditorium. (See also Fig. 26).

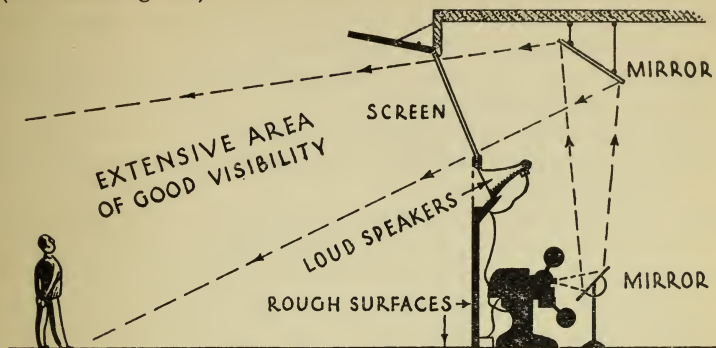


Fig. 26

SKETCH FOR EXHIBITION REAR PROJECTION UNIT
Using 16-mm. arc, plate-glass mirrors and Lucite screen (compare with Fig. 25).

Operators' Routine

Having set up your screen, loud-speaker, and projector, you should next arrange and connect the transformer and/or resistance, the non-sync and the speaker line.

CONNECT THE MAINS CABLE LAST.

Before starting a show carry out the following routine:—
ALL switches at the OFF position.

Adjust Transformer and/or Resistance for correct voltage.

Switch on mains.

Switch on motor, then the lamp, and lastly the amplifier.

Test for sound by flashing a torch over the sound optics—the “plops” then heard indicate that sound is being amplified via the P.E.C.

Check the Exciter lamp for correct position.

Test sound from the exciter lamp (or rays) by inserting a card in front of exciter with the volume full on. Movement of the card interrupting the exciter rays will be indicated by more “plops” from the loud-speaker.

Check the voltage again with everything switched on, but switch everything off, including the mains, before making any new adjustment.

Oil and clean your projector.

After oiling, run the motor for a few minutes.

Check that no excess oil has leaked or been finely sprayed on the condenser or on any other part.

Next, run a few feet of film and focus the lens, also check the tone and volume controls.

Check the non-sync by putting on a record.

Note the different positions on the volume control for the film and for the non-sync.

Lay out the tools required for an emergency, especially your torch, fuse-wire, pliers and screw-driver, and see that a spare projection lamp is placed in a handy position.

Having seen that the equipment is functioning to your satisfaction, there now remains the actual operating for the show, but there are quite a number of things to be checked before the final switching on.

The lacing of the film will depend on the design of the projector, but the principals of lacing are the same for every projector, especially the rule never to switch on before you are positive that the film is correctly engaged in the gate and with the sprockets.

Before switching on always check the following:—

Amplifier on.

Gate properly closed. Film correctly seated in the film channel.

Film engaged on all sprockets and correctly placed over all rollers.

Loops the correct size.

No slack on the take-up.

Sound/silent switch correct.

Forward switch correct. (Not at reverse.)

The clutch engaged.

The voltage constant and correct.

The person appointed to switch off the hall lights is ready for the signal.

The position of the fuse-box ascertained.

The Performance

When starting, switch on the motor first, but be ready to switch off quickly should the film jump a sprocket or a loop tighten. Next switch on the lamp as the first title appears and at

the same time bring up the volume. If you are using the non-sync lower its sound towards the end of the Censor's Certificate showing on the screen, and then change over to film sound and bring up the volume again. Re-focus, if possible, on the wording of the titles before they pass.

When the projector is running to your satisfaction, and providing the condition of the film allows you to leave it for a few moments, check up on the sound in different parts of the hall—you may find that the tone and volume need adjusting again.

In halls where the ceiling is arched or curved you may find that the sound is louder in the centre and perhaps slightly muffled at the sides, and it is sometimes possible to correct this by moving the position of the loud-speaker. But this is only an example, and as no two halls have the same acoustics, it will be necessary for you to experiment in order to get the best results. (Do not move the loud-speaker about during the show unless it is absolutely necessary.)

At the end of each spool switch off the lamp and lower the sound, then switch over to your non-sync and raise the volume again. (But not, of course, if you are using two projectors and are about to change over.) Always put a record on at least half a minute before the end of the spool. And don't give your audience swing music in the middle of a film on religion!

Switch off the motor when the film has passed the last sprocket wheel, then change the spools as fast as you can.

Should the film break during the show the motor must at once be stopped and the film relaced. Do not use the splicer until after the show. First remove the ends of the film from the projector, or only the take-up end if convenient, then relace the end from the feed-spool and run the motor until you have at least two feet of film to spare. This end should then be placed under the end hanging from the take-up spool. Next take up the slack so that the end on the take-up is wrapped over the end from the projector, then with a finger lightly holding the ends in place, restart the motor with the other hand. If you are not sure about this you should ask to be shown.

On projectors fitted with a belt-driven take-up, and providing the film has broken after clearing the last sprocket, it may be possible to tuck in the broken end onto the take-up without stopping the show. To do this the take-up spool is stopped

by gently "squeezing" it to a standstill, afterwards tucking in the broken end as described above. But, the whole operation must be done very quickly to avoid the film from piling up on the floor, and this is something which should not be attempted unless you have had plenty of experience.

NEVER ATTEMPT TO STOP THE TAKE-UP IF IT IS SPINDLE DRIVEN OR ANYTHING OTHER THAN BELT-DRIVEN.

Failure to stop the motor at once when a break occurs may result in the film being extensively damaged, and for this reason the operator should never leave the projector when it is running.

The projection light should always be doused before the last picture frame has passed through the gate, otherwise a flash of white light may appear on the screen—something never seen in the professional cinema.

During projection the operator must keep an eye on the screen, chiefly to watch the framing and the focussing, for both of these often require adjustment during the showing of each spool. The steadiness of the picture must also be watched, as a jumpy picture indicates that the gate may need attention.

The sound may also vary according to the condition of the print, but variations in volume should be gently counter-acted by the projectionist using the volume control, and care should be taken to prevent a burst of sound from the loud-speaker when an exceptionally good print follows one with a very poor recording level. Variations in volume and tone may change considerably, but they should not be noticed by the audience if the projectionist is doing his job properly.

Examining the Screened Picture

An eye should always be kept on the screened picture throughout the whole of the performance. Here are some of the things to watch:

First, the picture level in relation to the screen level. If the base of the screen is perfectly horizontal then the picture must be positioned likewise in order to avoid poor effects. The screen must therefore be solidly placed before the start of the show, and during the show the projector tilting-screws must be kept adjusted as and when necessary. If the projector has a non-theatrical framing-device, a tilting adjustment may be made each

time the picture-frame is corrected. And the framing (or racking) must be corrected immediately a frame-line shows upon the screen.

The focus, of course, also demands constant attention. The objective is usually fitted into a mount which is actually a part of the gate assembly and there is always a tendency for the gate to open slightly each time a join passes through it, which then results, perhaps, in the need for refocussing, but first ensure that the gate is still properly closed. Another thing to check is the tightness of the lens within its mount—if the lens is loose you may have to keep re-focussing throughout the whole of the performance.

Discolouration suddenly appearing on the screen is usually a warning that a lamp is about to fail, that the voltage has dropped, or that the lamp has shifted slightly out of alignment. Do not touch the lamp setting-screws unless they are easily moved as exterior controls, check the voltage to see that the lamp is not being under-run, and get another lamp ready for replacement.

If the picture suddenly or slowly becomes brighter, at once check the voltage to see if there has been an increase. A similar warning of excess voltage will be given by an increase in volume from the loudspeaker.

Dual Projection

The term “changing-over” implies the switching over from one projector to another in order to maintain continuity of a performance.

The two projectors are set up side by side, the distance between them being as described in Fig. 27.

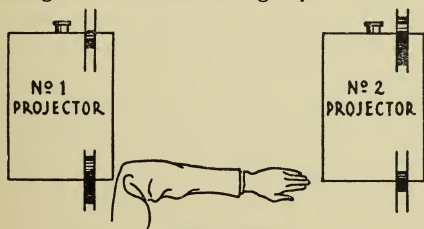


Fig. 27

DUAL PROJECTION

The distance between projectors equals the length of your forearm plus one or two inches.

To avoid mistakes in these and other instructions, the machines are described as No. 1 and No. 2 Projector. No. 1 is the projector on the left when standing behind it and facing the screen.

The two change-over cues are printed on the film in the form of small dots and they can be seen in the top right-hand corner of the picture. But they last only a fraction of a second, and in order not to miss them the projectionist has to stare unblinkingly at the picture until they appear. (Fig. 28).

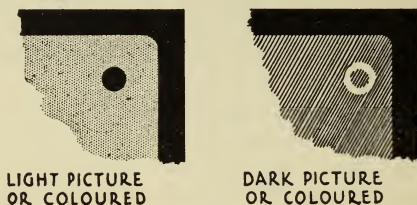


Fig. 28

CHANGE-OVER CUES

Look for them at the top right-hand corner of the picture.

Assuming that you are about to change-over from No. 1 to No. 2 projector, you will act upon the cues as follows:—

On seeing the first cue, switch on No. 2 motor and for a few seconds watch the leader running through the projector. But *before* the whole of the leader has run through the machine start watching the picture again for the next cue.

On seeing the second cue, switch on lamp and sound on No. 2 and at the same time switch off lamp and sound on No. 1. Make any necessary adjustments to No. 2, and then, when the trailer has run through No. 1 projector, switch off its motor.

A similar routine is followed when changing-over from No. 2 to No. 1, of course.

You will notice that the above instructions are dependent on the film being already laced-up in the next projector to be used and also that the length of the leader on the following film corresponds to the length of film still to be projected by the machine in use. In other words, the leader must equal the distance between the two cues. This means that a pre-selected frame has to be laced-up in the gate, but this does not imply that the frame has to be always the one marked "picture" or "start".

Some projectors take longer than others to reach normal speed on starting and on a slow-starting projector, for instance, it might be necessary to lace-up the film in the gate at a point about one foot after the "picture" frame. To help you locate and remember that point, you should make use of the series of numbers printed on the synchronising leader. These numbers are marked, after the frames marked PICTURE and SOUND, 11, 10, 9 and so-on down to 3, after which comes the title or picture.

For example, if a "slow" change-over is made when the PICTURE frame is located in the gate, rehearse with 11 and then with 10, etc., until you find the correct frame for a proper change-over.

The first cue to appear on the screen is known as the *motor cue*, and the second as the *picture cue*. The picture cue is located a few frames from the end of the reel in order to allow for slowness in switching off the lamp and sound.

To carry out the instructions above, it will be necessary for the film to be correctly laced and located in the next projector, to have the amplifier already switched on, and the tone and volume controls set in a position similar to those on the projector which is working. But should the next projector be very hot, the reel to follow should not be laced-up until it has had time to cool down—wait until there is about five minutes to go before the change-over. If the film is left in a heated gate for some time it will warp, dry out, and perhaps break when finally projected.

When preparing a projector for a change-over, lace the film from spool to spool but with the required frame a few inches before the gate—the inching knob can then be used to work the mechanism by hand and so bring that frame directly over the aperture. Doing this will also allow you to check the lacing and at the same time it will take up any slack on the take-up and feed. The clutch, of course, must not be disengaged.

Change-overs on Projectors having One Switch Only

One or two makes of silent machines have only a single switch which controls both lamp and motor, and with these a slightly different procedure must be followed when changing over.

Assuming that you are about to make the change from No. 1

to No. 2 projector, lace up the next reel to be used on No. 2 with the first of the actual title or picture-frames correctly located in the gate. The synchronising leader is ignored in this case and also, no action will be taken when the first cue appears.

On the second cue appearing, switch on No. 2 and at the same time switch off No. 1. After making quite sure that No. 2 is running to your satisfaction, remove the film from No. 1 by unlacing its trailer and then wind it up by hand.

Making Change-over Cues

Although recent standards have been agreed upon for the size and position of cues and leaders, etc., you will still find an occasional library film which perhaps has no cues at all and a sync-leader too short to be of any use. In some cases the cues may appear in the *bottom* right-hand corner of the picture but that, of course, indicates a mistake in printing. We only mention this to put you on your guard. If you cannot see the first cue at all and the reel in use is almost at an end, you must take a chance and start the change-over as though you had seen it!

You are not permitted to make your own cues on a library film. If you do, you will be accused of mutilation. But there is nothing to stop you from making cues on your own films. They can be made by very carefully scratching a small dot or circle on four consecutive frames or, if the frames be very light in tone, by applying the dots with black ink.

Mark the *second* cue about one foot from the end of the picture-frames at the end of the reel, and then make the *first* cue at a distance along the film equal to the distance between your own particular leader start-frame and the first of the title-frames.

It is important to make the dots each exactly the same size and in exactly the same position on each frame. And make them as small as possible—they will look large enough when the picture is projected on the screen.

Change-over Units

Small compact units are available which allow both projectors to be controlled from a central point. They are supplied by most manufacturers of sound equipment and as with other acces-

sories, it is important to obtain one specially matched to the projectors.

The change-over unit is electrically connected to both projectors and is provided with two or more switches which enable the operator to make the change-over without actually touching the controls of the projectors. A simple movement of one switch starts up the motor of the next machine to be used, whilst another will produce a smooth change-over of both picture and sound.

The use of a unit which can only produce a *simultaneous* change-over of picture, however, may not be completely satisfactory for projectors fitted with filament lamps and having no dowsers control. A filament lamp may take a full second or more to produce full brightness on starting, and a unit which incorporates means of momentarily delaying the switching off of one lamp until the other has achieved full brightness may be a necessary adjunct for perfect dual projection.

On the other hand, such a delayed action would entail a momentarily double load on the supply circuit and before such a unit could be used precautions would have to be taken against the possibility of a fuse blowing. But when using any kind of change-over unit, similar precautions should be taken for the double load.

Apart from any such drawbacks, however, the change-over unit is often a necessary piece of equipment to the user of dual projectors, unless they are of the type which have no separate exciter. In that case, excitation originates from the projector lamp and can only occur when the lamp is switched on, thus enabling a change-over to be made for both picture and sound by using the lamp switch only.

Monitor Speakers

The monitor is a separate loudspeaker installed in the projection-room and its use permits the projectionist to gauge and control the sound in the auditorium which perhaps he cannot hear direct.

It is preferable to obtain one fitted with its own volume control, as this allows its sound to be *in proportion* to auditorium-sound. Blaring sound at auditorium-volume is quite unnecessary and can easily cause the projectionist to develop a neurosis.

All 16-mm. statics should be equipped with a monitor and probably are, but other film users who have made a projection-room for themselves will also find it of considerable value.

It can easily be wired, in series, with any existing loudspeaker, though you must ensure that it is of similar impedance and voltage. If you are thinking of buying a monitor, have it fitted and working to your satisfaction before concluding the deal.

Continuous Projection

This relates to the use of special equipment enabling a complete programme to be run through a single projector without a break. The entire programme is joined together and wound upon a giant spool, and a separate motor may be incorporated for handling the extra strain on the take-up.

These continuous-projection devices have much to be said in their favour, but before using such equipment, first ask your film librarian if there is any objection to you using it with his films. It is also a good idea to ask the library which type they recommend if you are thinking of buying one, which will ensure that there will be no objection when you begin to use it.

It is quite possible, however, that you may have heard of a method of giving continuous shows with one projector without using any special apparatus. If you do know how it can be done, please remember that it is not permitted when using library films. The only way in which you can give a continuous show with one projector is by using the special equipment mentioned. If other methods could be adopted without raising a storm of protest, you would read about them here.

Arc Projection—16-mm. Only

A number of professional 16-mm. arc projectors have now made their appearance and a few words on their use can be included in this book.

An arc lamp basically consists of two rods of carbon, fed by an electric current.

The term "trim the lamp" means inserting new carbons or aligning those already in the lamphouse. "Striking the arc", which means switching them on, entails bringing their tips together and then separating them to form a small gap of pre-determined width. The carbon points then begin to burn and produce a powerful concentrated light.

All 16-mm. arcs, with only rare exceptions, are known as horizontal arcs (Fig. 29), which merely describes the fact that both carbons are positioned tip-to-tip and in line with each other.

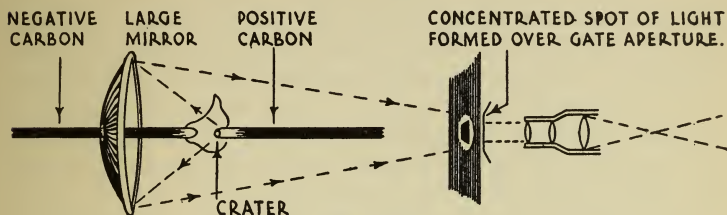


Fig. 29

HORIZONTAL MIRROR ARC

The crater, formed in the tip of the positive, faces the mirror.

One carbon is known as the positive and the other as the negative, and the positive may be recognised by its slightly greater diameter and by the crater which forms in the tip when it is burning. Note that the crater of the positive always faces the mirror, or if there is no mirror, the condenser lens. But condensers are seldom fitted in horizontal arcs, which explains why they may also be known as mirror arcs.

Positive and negative carbons may be slightly different in their material composition and must not be interchanged in the arc-lamp. And they are still called negatives and positives even though they may be used on A.C. mains.

The composition of A.C. carbons may also be different from carbons used on D.C. Those supplied with the projector will be of a certain length, diameter and composition, and they must only be used on a current supply recommended in the makers' instructions. Serious loss of light may occur if the arc is over-run or under-run, so the projectionist must always keep an eye on the ammeter governing the arc carbon-circuits.

As the carbons burn, they are slowly moved inwards, usually by an automatic "feed", so that the gap between them remains the whole time equidistant. The life of a carbon rod may be from 30 to 50 minutes, or perhaps about three hours, the longer carbons, of course, being used only in those projectors which can accommodate them.

Do not be caught out by letting a carbon burn away before

the end of a reel. Time both positive and negative carbons the first time you use them.

New carbons may contain a certain amount of moisture, which is the cause of the arc "spluttering". The moisture quickly boils and blows off minute particles of carbon, which, impinging on the mirror or condenser, produce a form of damage known as pitting. To prevent pitting, a special shield is first brought into position in front of the mirror when the arc is struck and it is kept there until the spluttering stops. At the end of each reel the mirror should be brushed with a special brush of the type which cannot harm the surface.

But to prevent any such damage as pitting, new carbons should be made perfectly dry before they are used, so purchase them in bulk and store them in the dryest place you can find. The next set of carbons to be used can be placed on top of the lamphouse for a few minutes, so that they thoroughly dry out.

Complete instructions on the use of arc projectors are issued with each machine purchased, but for the reader who requires further information on the subject of arcs, we recommend "The Complete Projectionist" by R. H. Cricks, and Richardson's "Blue-book of Projection". These books are of course written principally for 35-mm. users, but there is little difference between 35- or 16-mm. arcs—it is merely a question of size.

Coloured Films and Slides

The chief thing to remember when using coloured films is that they usually require a little more light, and that this must be considered *before* starting a show. More light usually means more voltage to the lamp, but as very few projectors are fitted with a variable lamp control, it is usual to control the voltage to the lamp by means of the transformer tappings. The necessity for a transformer having an adjustable tapping device which may be used during projection at once becomes obvious, for without such a device, the operator may have to stop the show in order to adjust the transformer. But this should not be necessary when using a 750 or 1,000-watt lamp, unless, of course, the length of throw is excessive, or the print unusually dark.

The "average programme" now often includes at least one coloured film among a number of monochrome ones, and for such a programme the fixed-type transformer should be ad-

justed (before the start of the show) to give sufficient light for the coloured film, care being taken to see that the voltage does not exceed the limit of the lamp's rating, i.e., a 110-volt lamp may be run at 115-volts, but only for short periods, and only when absolutely necessary for better lighting. It is not advisable to do this, however, unless you have a spare lamp at hand, as over-loading the lamp considerably lessens its chance of survival after middle-age!

Another thing to remember is that coloured films may have the emulsion on either side, and it is impossible to foretell on which side it will be until you are able to examine the film. Coloured films must therefore be watched in relation to the sound, for the scanning beam is finely focussed on one side of the film only—the emulsion side. Re-focussing the projection lens is nearly always necessary, but to alter the focussing of the scanning beam is something which should not be attempted unless the operator is sufficiently skilled, or is positive that the cause of low sound is not due to something else—a print with a low recording level, for instance. Any alteration to the sound-optical system must be carried out with extreme care and gentleness, as the slightest adjustment either improves the sound or entirely eliminates it, and both the operator and the audience are thus likely to be surprised.

The use of coloured slides call for the same precautions as with films—sufficient light, and refocussing whenever necessary. But always attend to the voltage **BEFORE** the show.

At the End of the Show

Immediately after the end of the performance, switch off and disconnect the mains lead. If the equipment is then to be packed up and taken away, next follow this routine:—

- Wind up mains-cable
- Disconnect and wind up speaker-cable
- Lower and pack-up screen
- Count and pack films
- Count and pack spares
- Fold or disconnect spool-arms on projector
- Put all switches at "Off" and controls at "Zero"
- Lower projector tilting-device

You will notice that these instructions require you first to

remove those parts of the equipment which might be interfered with (cables and screen) and that the projector is one of the last things to be moved. This is to allow time for the lamp and valves to cool down first—an important item which helps to prolong their life.

When the whole of the equipment is packed and all dust covers in place, take a look around the hall to see what you have forgotten. The loudspeaker grill-cover is usually the first part of the equipment to get lost ; after that the projector-stand screws disappear. After folding up the stand, tighten the screws so that they cannot fall out.

And before leaving the hall, replace any lamp bulbs or connections you may have moved and leave everything as you found it.

8

Servicing Equipment

Lubrication

OILING SYSTEMS vary with the make of projector used, and operators should find out for themselves the number of oiling points on their machines, and also, the correct number of drops for each point.

Disregard the "experts" who tell you to oil little and often. Instead, pay special attention to the instructions on oiling issued by the manufacturer of your equipment. These instructions should tell you the number and positions of the oiling points, give a certain period for each oiling, and list the correct number of drops for each point.

Many manufacturers also prefer you to use a certain type of oil for their projectors, and in some cases even supply their own of a special kind, and ask you to use no other. If you cannot get the correct oil, then use sewing-machine oil, but do not use any oil which has cleaning and rust-removing properties.

Below is the Lubrication Chart issued by the makers of the Bell & Howell "Filmo" projector—note that the oiling period is different for sound and silent speeds, but the number of drops is the same:—

	SILENT SPEED	SOUND SPEED
Oil Cup A	One drop of Filmo Projector Oil after each 8 hours of operation.	One drop of Filmo Projector Oil after each 4 hours of operation.
Oil Cup B and C	One drop of Filmo Projector Oil after each 32 hours of operation.	One drop of Filmo Projector Oil after each 16 hours of operation.
Oil Holes D	Saturate felt reservoirs every 6 months.	Saturate felt reservoirs every 3 months.

The chart, of course, should only be followed by the actual users of the Filmo projector, and is only given here in order to illustrate what has been said concerning the importance of correct oiling. Always oil before, not after, a show.

Apart from following such instructions, you must also be extremely careful not to drop any oil on any other part of the projector. Many oils spread rapidly across a metal surface, so make a habit of always wiping the mouth of the oiling-point as a safeguard against this, and on no account over-oil. Never forget that oil will ruin the sound and damage the films if used carelessly, and remember also to keep your hands clean.

Failure to oil the projector may result in the mechanism "seizing up," and if this happens you will have to return the projector to the service depot—a somewhat costly business, but easily avoided.

In some projectors there may also be points which require greasing, and here again you must pay special attention to the manufacturers' recommendations. Any part of the projector which gets warm in operation must not be greased unless the grease used has a very high melting-point. Ordinary grease will not do, as it would very soon melt and make quite a mess of your projector.

It is the usual thing to run your projector for a few minutes after lubrication, and then to carefully examine all surfaces for any signs of oil or grease which may have leaked on or near the film track. Excess oil may be thrown out from the mechanism in the form of a very fine spray, and if this happens it will be drawn into the aperture and perhaps coat the condensers and lamp as well, so include these parts in your examination before projecting.

Cleaning the Projector

Your projector must be kept absolutely clean and in perfect condition if you expect to give trouble-free shows, and although the method of cleaning will vary according to the projector, there are, nevertheless, certain golden rules which all projectionists should learn by heart, and which apply to all sound and silent machines irrespective of their make.

Most important of these is the injunction never to scratch any surface likely to come into contact with the film. It is known

that at least one instruction book advocates the use of a bone or hardwood scraper for cleaning the gate, but on principle the author strongly disagrees with such advice. A piece of wood, no matter how soft, will eventually cause scratches upon a steel surface, simply because the grit and dirt it is supposed to remove becomes embedded in the wood itself.

Dust, and the emulsion scraped from the film, will usually collect and build up in the gate and on the edges of the sprockets, and this should be removed by means of a brush. Special gate brushes may be purchased, and these are ideal and a lot safer than any other kind. The brush should be used for cleaning the gate after each spool and before every show, but dirt which has to be removed by the use of a solvent will indicate by its presence that you are not using the brush correctly or as often as you should. Carbon tetrachloride, methylated spirit, or any other suitable solvent may be used for cleaning the metal surfaces of the film track, but the latter should be polished with a clean rag afterwards.

Surfaces of chrome, however, should be cleaned only by using a special chrome-polish—not ordinary metal-polish.

Seven Commandments

Always oil your projector where and whenever necessary.

Avoid scratching at all times.

Keep it spotlessly clean.

Never force any part which will not fit properly.

Never experiment—ask about anything of which you are not sure.

Never service the projector with the mains connected. Switch off and disconnect the electricity supply first.

Nothing “live” should ever be exposed.

And remember—CARELESSNESS KILLS!

The Lens

Both projection and condenser lenses require daily cleaning. Dirty condensers lead to loss of light, and dirty projection lenses result in poor definition. They are made of a special optical glass, which may easily be scratched, being somewhat softer than ordinary glass. Because of this, dust should be removed by blowing before cleaning and polishing.

Linen or chamois-leather used for cleaning the lens should be very soft, and the latter not of the kind which has been treated by any oil or tanning process. Special cleaning outfits and special lens cleaning-fluid may be purchased at most cine dealers, and if you value your projector it is well worth going to the expense of getting the right equipment for servicing it.

When cleaning the lens first remove the dust, either by blowing or by using a soft camel-hair brush, then use the cleaning fluid by gently wiping, and lastly polish with a clean piece of cloth or soft tissue paper. A special type of lens cleaning-tissue may also be purchased. The cloth, preferably linen, should not be of the type likely to leave minute hairs sticking to the glass, and it must be quite clean and dry before it is used. The cleaning fluid should not be poured onto the lens, a moistened cloth being quite sufficient.

After you have finished cleaning the lens replace it and switch on the projector lamp—you will then be able to see if it is properly cleaned or not. If the lens show a fine bluish film which can be removed by your fingers but not with the cloth then the cleaning-fluid or the cloth is no good, and you had better try another kind. But remember that lens "blooming" or "coating" also produces a fine bluish film such as that mentioned above. Make sure, therefore, when cleaning the lens that you do not cause unnecessary damage.

Spare lenses are best kept in tissue paper or cotton wool, and packed away so that they cannot move or get damaged.

Motor Care

The electric motor does not usually require any lubrication, but this does not apply to adjoining bearings, and depends, of course, on the type of machine. Operators should watch the motor for excessive sparking, and ensure that the carbon brushes are not in need of replacements. The commutator segments must also be kept clean by means of a piece of cloth on the end of a match-stick, but not, of course, with the motor running nor even with the mains connected.

The bearings of a motor are usually packed with grease, and as a rule these should be examined after every hundred showing-hours. Where the grease is packed within a screw-top filler the screw should be given one complete turn at the same period.

When the screw is tight it must be removed and the cap refilled, and then replaced with just sufficient turns to force the grease into the bearings.

The commutator is that part of the motor which resembles a brass wheel with its surface equally divided by many transverse sections, and which revolves on the motor spindle. It can usually be turned by hand, and if the projector is fitted with a clutch the latter should be disengaged when turning it.

Wire Belts

All belts should be removed or released when the projector is not in use, as this will prevent them from losing their elasticity. Belts which have become broken can usually be repaired quite a few times before being scrapped. It is only necessary to bend out a fresh loop from the end of the wire belt and connect it as before. In some cases a belt which has become too short for one position may be used for another, but wire belts should not be changed unless they are of the correct diameter. They should not be allowed to get rusty, but on the other hand they must not be greased if they are to be used for a friction driven take-up.

Screws and Rollers

Screws which hold idler-rollers in place are usually unscrewed in an opposite direction to the way the rollers turn when spun by the passage of the film. Both right and left-hand screws may be used in the same projector, so remember this when you find a screw sticking—try it the other way, and see which way the roller spins with the film. They are usually so designed as to tighten automatically when the roller is turned by the film.

Other rollers may be attached to springs, especially in sound projector smoothing systems, and these springs must be kept at just the right tension, being changed at once if in any way faulty.

Sprockets

All sprockets must be periodically inspected for signs of wear and if found to be badly worn they must be at once replaced. Badly worn sprockets cause quite a lot of damage to the perforations, which in turn will cause other faults in projection—

an unsteady picture, for instance.

It is sometimes possible to reverse the sprocket-wheels on some 9.5 and 16-mm. silent machines so that the sprockets are given even wear, but this should not be attempted on any 8-mm. or any sound projector other than post-1950 9.5 mm. models. You should be able to see at once whether the sprocket-wheel can be reversed or not by the design.

Sprocket-wheel guards or pads also have to be periodically inspected, especially to see that they maintain the correct clearance when in the closed position.

Your gate-brush can be used to clean the sprockets and rollers, taking care to clean the inside of the rims and making sure that all dirt is removed.

The Daily Clean

Look after the projector blimp and loud-speaker case, and keep them cleaned and protected by using a wax polish. The speaker case, however, should not be highly polished, as reflecting surfaces near the screen may spoil the picture.

The cables and leads (but not flex) should occasionally be cleaned with a moistened cloth, but have everything dry before starting the show.

Every day, and just before starting a show, the operator should carefully clean the following:—Projection lens, Condensers, Lamp, Sprockets and Idler-Rollers, Gate or Film Channel, and any other parts requiring cleaning. Dust the exposed parts of the sound optical system with extreme care and gentleness—a camel hair-brush or feather should be used. Avoid using any materials likely to scratch.

The Weekly Clean

When a projector is in regular use, it becomes necessary to carry out a servicing routine at least once a week or after every ten shows. This routine should be designed to detect signs of wear and also to give attention to any minor faults before they have the chance to develop into major ones. The items now listed will help you to make a methodical check.

Before carrying out any repairs or cleaning, switch off and disconnect the mains cable.

1. Examine the objective and condenser lens. See that all

elements are tight within their mounts, except perhaps, the condenser nearest to the lamp, and that there is no discolouration or cracks. Whitish patches in the lens may be caused by decomposition of the cement which binds the elements together ; do not attempt to rectify such troubles yourself. Lenses may be serviced at little cost by most optical dealers or by the manufacturers.

After cleaning the lenses, wrap them up in paper until you wish to replace them—after you have finished cleaning the rest of the projector.

2. Remove the projector lamp and the amplifier. Brush out the inside of the lamphouse and the space from which you removed the amplifier. Next clean the inner section of the gate and aperture, heat filter, heat plate, shutter and if fitted, the dowsing blade. And use only a very soft brush or feather. Next clean, with the proper gate-brush, the gate, lens mount and all rollers and sprockets. You will notice that quite a lot of dirt may be shifted but not entirely removed, so the next thing to do is to re-connect the mains and switch on—the fan should then blow out all loosened dirt.

When you have done that, switch off and disconnect the mains, clean the reflector, clean and replace lamp, replace cleaned condensers and then clean and replace lamphouse cover.

3. The exciter lamp, if fitted, should be examined next. Check that the bulb has not darkened and that the filament has not sagged. Clean, replace and then check its alignment with the sound optics. Dust very gently all exposed parts of the sound optical-system with a feather. Do *not* use a cloth wrapped around a screw-driver.

4. Examine the motor and if necessary clean the commutator segments. Check the brushes for signs of wear other than normal—cracked, broken or very short brushes should be replaced. But remember that most brushes will last quite a long time and as a rule do not need replacing until they have become too short for proper contact. Ensure also that the springs which hold the brushes down are equally efficient.

Attend to motor-bearings and grease or oil as required by your operators' instructions.

5. After cleaning as much of the projector as you can, you should next go over it very carefully and tighten-up all the

screws you can find. There may be dozens of them, of course, but you are sure to find at least one which has worked loose. Screws must all be tight, but at the same time they must not be forced. In particular, do not force any screws in the lens mount or exciter base, nor any you find in the valve bases. Screws which hold the exciter base in position will flatten the exciter-base or cap if forced in too far.

Whilst you are attending to the screws, examine all parts for damage and signs of wear. And ensure that all moveable parts have no excess or restricted movement.

6. Clean all external wire belts and replace those which are kinked or stretched. Remove all grease from the inside rims of the pulleys to prevent the belts subsequently slipping during projection. If the take-up head is efficient, *leave it alone*. Before replacing the belts, attend to any oiling-points in the pulleys and take-up ; the grease-point in the pulley attached to the motor is usually the one most neglected.

7. The amplifier should now be freed from dust, preferably with the aid of a vacuum cleaner. See that all valves are properly seated, and clean the photo-electric cell. When replacing the amplifier, do not omit any rubber rings which go with the screws. The rings, or cushions, are intended to absorb vibration which may be transmitted to the amplifier from the mechanism and for this reason the screws must not be forced in too far so that the rings are entirely flattened.

8. Clean and tighten all electrical connections, including those on the mains and speaker cables, plus those on (or used for) the transformer and/or resistance units. Make new connections where you find the wire frayed or partially broken.

9. Now attend to the projector stand. Oil the hinges if required and repair any faults you find.

10. Clean the loudspeaker, but only if necessary, but do not interfere in any way with those parts which are normally kept covered. Examine the wiring of the mains input which you can see in the back of the speaker and look for poor contacts, etc. And, of course, tighten up any screws you may find, especially those which hold down the carrying handle.

11. When you have finished servicing the equipment, connect the mains and switch on and let the projector run for a few minutes. You can then see what damage you have caused.

Dispatching Equipment by Rail

It is possible that you may one day have to dispatch your equipment by rail and the following tips will help you to avoid making mistakes.

In the first place, the equipment can be insured with British Railways at any main line station and the small premium required is certainly worth the outlay as a guard against loss or damage. The projector can also be sent "Glass Rate", which ensures that it will receive careful handling by the railway staff.

As you do not want the equipment to take a week to reach its destination, you should mark all labels "PER PASSENGER" and if necessary, advise the recipient of the time and place of arrival of the train. It is best sent to the recipient "care of so-and-so at so-and-so Parcels Office"; it can then be personally collected with the minimum of delay and without further handling by road transport staff.

Projectors fitted with an oil reservoir or sump must be completely emptied of oil before sending them by train, a B.R. regulation which must not be ignored. But this is also good advice, as you would certainly not want the projector to arrive with the amplifier swimming with oil.

In most cases there will be no need to send the equipment complete with lamp and exciter, but on the other hand it is always a good idea to have the valves and cables tested when the equipment is serviced, so you might consider whether to leave them in the equipment or not. Leave the valves in their proper sockets, but put plenty of soft paper or rag around and over them to prevent them moving. If the lens is left in, see that it cannot be damaged—wrapping and fixing it to the inside of the projector will ensure that it will not be damaged and also that it will not be found in its usual place should someone covet it *en route*.

9

Faults and Fault-Finding

Correcting Faults During Projection

NOT all the faults which develop during a performance mean that it must be interrupted in order to effect a cure. Many can be quickly remedied by the promptness of the operator in dealing with them as they occur and quite often a complete breakdown may be averted without the audience suspecting that anything is wrong. But the correction of a fault before it has the chance to develop naturally depends on the operator always keeping an eye on the machine during the whole of the performance.

The correct position for the projectionist is at the operating-side of the projector and he should not leave this position unless he has to. You cannot expect to be able to deal with faults as they occur if you are standing at the back of the hall, and no matter how good you may be, or how good your projector, your proper place is by the side of your machine.

Loss of Bottom Loop

Probably the most common of all faults is a lost loop in the film below the gate. Usually caused by damaged perforations, or perhaps by a badly-made join, etc., it is yet always indicative that the operator has failed to examine and repair the film before using it.

On some machines the loop is made around a trip-switch, which will automatically stop the mechanism should the loop tighten against it. With these machines a lost loop always means an interrupted show, but on the other hand further damage to the film is thus prevented. But not all projectors are so equipped and a lost loop may occur on almost any type of projector when using a film in poor condition. You may perhaps imagine that

those machines fitted with triple-claw movements, which engage three perforations at a time, are of the type on which a lost loop would be a rare occurrence, but unfortunately this is not the case when the film is definitely bad.

The important thing to remember, however, is that the loop is often lost by degrees and that it may only partially tighten each time a torn perforation or badly-made join passes through the gate. A diminished loop also means a lessening of film distance between picture-frame and relative sound, with the result that perfect synchronisation of the two is lost. And as synchronisation thus depends on maintaining the loops the correct size, any partial tightening of the loop must receive immediate correction by the operator. Continual correction will also ensure that the loop is never completely lost, which in turn means prevention of all the minor faults which often follow in train. Some "skilled" projectionists do not allow the loop to tighten at all if it can be prevented. They will watch each join as it passes through the gate, and should the loop be seen to tighten it is snapped down again by giving it a light but sharp pull with a pencil, or with some other object equally smooth. The time taken to achieve this correction should be considerably less than one second, as compared to a full second or more taken to switch off the lamp and motor and bring the mechanism to a complete standstill, plus, of course, the time taken to correct the loop and start up again. Reckoned at so many frames of film per second, the time thus saved surely merits consideration.

The orthodox among projectionists may frown upon such methods as that of lengthening the loop without first stopping the machine. And they are right, of course, for the general instruction for dealing with lost loops is that the mechanism must be stopped at once if one is to avoid further damage to the film. And make no mistake about the damage which does occur on such occasions, because for every second taken to switch off the motor there will be at least twenty-four frames of film damaged (at sound-speed). But these are the kind of faults which can be checked almost at once by the operator, if he happens to be around, of course.

Projector Will Not Start

THIS MAY BE because the house current is switched off or a

fuse has blown. Check that the current is actually reaching the point at which your mains cable is connected, and if necessary test it with a voltmeter or by using an ordinary electric lamp. Make sure that the meter governing the supply is not of the coin-in-the-slot variety.

If the current is definitely reaching the power-point you must next test your mains cable and its connections, and also any fuse which may be built-in in your own equipment. Fuses may also be found in the transformer (or power-unit), in the base or rear of the projector, or actually within the plug-connector. If your projector is fitted with an inching-knob use it to turn the motor over by hand, but on no account must you touch the motor itself.

When you are positive that the current is reaching your projector but still without any results, look for one of the following:—Motor wiring partly or completely burnt out. Brushes not making proper contact, either through wear or loose springs. Mechanism “seized up,” due to lack of lubrication. Faulty motor switch, or switch circuit-wiring. Grit or dirt clogging gear-wheels of main drive—try putting the motor in reverse if the projector is so fitted. Motor requires new windings. Check for any smell of burning, and also examine grease-caps of motor bearings.

Projector Running Slow

First check the sound/silent switch, and then see that the voltage is correct. If the pressure is sufficient the trouble may be due to lack of lubrication—examine grease points (if grease is used) of the intermittent movement and motor bearings. Other possible causes may be any of the above, plus poor contact points in the automatic speed-governor, or partial contacts in the wiring. If the projector is fitted with a clutch disengage it and let the motor run for a few minutes.

It the motor slows up every time you switch the lamp on, it is probably because the voltage is too low—check the resistance or transformer tappings.

Projector-speed Varies

Faulty transmission; lack of grease in mechanism or motor-bearings; faulty speed governor. After checking the grease

points, examine the motor and governor brushes and the governor contacts. (See Figs. 30 and 31). Ensure also that the voltage is of sufficient pressure and not fluctuating.

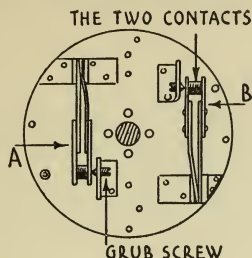


Fig. 30

THE AUTOMATIC 2-SPEED GOVERNOR

Centrifugal force tends to throw outwards the arms marked A and B. When the contacts open the electrical circuit is broken and the motor thus prevented from speeding. Whichever arm has the strongest spring (A or B) is the one controlling sound-speed. The other is for silent speed. The contacts sometimes need adjusting or clearing.

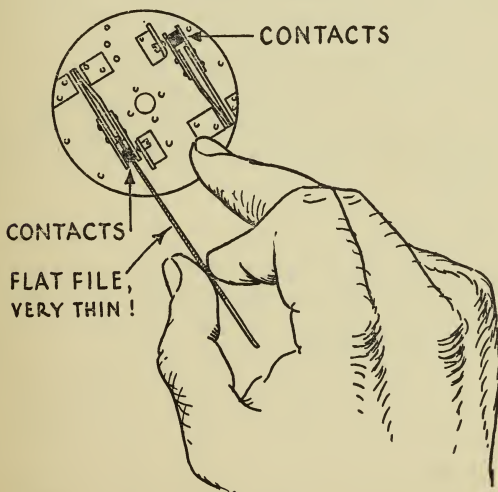


Fig. 31

SHOWING METHOD OF CLEANING GOVERNOR CONTACTS

Loss of Top Loop

This is nearly always caused by leaving open the feed-sprocket guard, though it might also be caused by two or more torn perforations. Make a habit of checking the lacing of the film before switching on.

Projector Lamp Fails

Premature failure of the lamp is usually caused by excess voltage and a new lamp should not be used in its place before the voltage has been carefully checked. Check both the mains supply and the output from your transformer or resistance unit, and make sure that the lamp is of the correct rating for the current in use.

Should a second lamp fail as soon as it is switched on, the most probable cause will be a short circuit somewhere between the transformer/resistance and the lamp. A break in the mains-transformer cable, for instance, might isolate that unit from the remainder of the lamp circuit, which would allow the full mains voltage to reach the lamp. When a new lamp is given too high a voltage, it usually gives one glorious burst of light before setting you back five shillings. When that happens, do not risk another lamp until you have found and corrected the fault.

No Picture, But Voltage Supply Correct

This may be caused by any of the following: — Dowser switch forward. Lamp burnt out. Lamp switch not on. Lamp not correctly seated or not making proper contact. Faulty switch or switch wiring.

Poorly Lit Picture

Low voltage; blackened lamp; room not sufficiently blacked-out; dirty optical system; the film itself is dark.

Picture Lacks Definition

Lens not properly focussed; Projection lens dirty; gate not properly closed; the film itself is faulty—a poor print.

Jumpy Picture

Gate not clean; gate not closed properly; incorrect tensioning of pressure (side) rails, runners or shoes. See if a light finger

pressure on the aperture pressure-plate will stop the jumping till the show is over.

Examine sprockets for wear, and also the claws if fitted. Make sure that the film perforations are not torn or strained.

Flicker

This may be caused by the projector running too slow, or because the shutter has become slightly displaced and is thus out of time with the mechanism.

Irregular flickering of the lamp is another fault, caused by poor contacts in the lamp circuit, or perhaps because the lamp is not properly seated.

A mercury-arc lamp may also produce a "beat" if used without proper accessories, or unless the speed of the projector is increased or decreased by about one frame per second.

Irregular Take-up

"Snatching" of the take-up is caused by the belt slipping, or perhaps by the belt catching in some part and being momentarily checked. See that the connecting link in the belt is not the cause of the trouble, especially if projecting with the belt crossed. Excess heat, or undue noise in the take-up head may be the first sign of wear. If the condition is bad, remove the belt and take up the film by hand-winding the spool; this will save further damage to the perforations.

Usually, however, the cause of the trouble is skidding (instead of gripping) of the wire belt, and there is no reason why the operator should not try to cure this trouble without stopping the show. Grease can be removed by wrapping a piece of cloth around a finger and then pressing with it against the inside of the belt. Providing that the cloth is held taut, there will be little chance of it being caught in the belt, as would be the case if the cloth were loosely held or wrapped entirely around the belt.

Take-up Failure: (A) Direct Drive, (B) Belt Drive

(A) Failure of the take-up may be caused by the transmission at fault, or because the take-up arm has become disconnected. Transmission faults include a bent spindle or perhaps

a broken tooth in one of the gearwheels. Check the lubrication, and see also that a bent spool is not the cause of the trouble.

To re-engage a take-up arm without stopping the show; first spin the spool in the same direction but faster than normal, then gently re-engage the arm, but keep up the spinning and then gently slow down until the motor "takes over."

Serious damage may result if the arm is re-engaged without the spool spinning slightly faster than the normal rate, but do not attempt this unless you are quite sure you know how.

(B) On projectors fitted with a belt drive the most frequent cause of failure is due to the wire belt slipping, which may be due to slackness or the presence of oil.

Another cause may be that the friction device within the head is worn, or perhaps it requires adjusting according to the size of the spool you are using. The groove in the outside rim of the pulley may also have become too smooth with continual wear, and with the result that the wire belt fails to grip, but this is usually a fault found only in old machines. Bent spools may also cause trouble, and they should not be used on the take-up.

Shutter "Ghost"

This applies to white streaks appearing on the screen, and is due to displacement of the shutter on its spindle. Fig. 32.

It cannot be corrected under five minutes except by an expert. A top ghost is due to the shutter being retarded and a lower one due to it being advanced. (See that the edges of the aperture are not too shiny).



Fig. 32

VARIOUS SHUTTERS AS USED IN NARROW-GAUGE PROJECTORS

Feed-Spool Tensioning Weak

It is quite simple to prevent "freewheeling" of the feed-spool should the tensioning or braking-device fail. Assuming

that you have not omitted any belt which should be attached to the spool-arm, you merely place a finger against the spool and lightly check it so that the film is pulled evenly and without being jerked. This is all very simple, of course, but consider what would happen if the film was allowed to loop off and be pulled into the projector in a series of jerks: The perforations would be torn by the first feed-sprocket, and the torn perforations might cause the bottom loop to tighten, or perhaps cause the film to ride off one of the sprocket-wheels altogether.

This in turn could result in interpuncking, poor sound, and an annoyed audience, plus of course, a subsequent altercation with your film librarian!

Tightening of Feed-Spool Braking Device

This is nearly always caused by twisting a belt which is supposed to run straight, or vice-versa. The braking (or tensioning) device can usually be adjusted by turning a screw, in some cases situated below another at the top of the feed-arm. If it cannot be correctly adjusted it should be completely loosened for the duration of the show, and if necessary the operator should gently check the feed-spool by hand. The lubrication should also be checked.

No Sound

This may be caused by quite a number of faults, ranging from the amplifier not switched on to a deteriorated P.E.C. Check the exciter lamp, and all connections, including those linking up with the loud-speaker. Look for defective valve(s) in the amplifier. If operating on D.C. try reversing the connector at the end of the mains cable.

If the exciter lamp is working check the volume control, the lacing of the film, and attend to the cleanliness of the sound optics. See that the amplifier connections are secure, including the valve grid-clips, and that the valves are properly seated and in their correct positions. Flash your torch over the P.E.C. and listen for the speaker response. If this is correct examine the sound-track on the film.

When the amplifier valves are wired "in series" the lot will fail if one blows, and in this case it will be quicker to change them all at once and wait until the show is over before experimenting to isolate the faulty one.

Low Volume

This may be caused by low voltage, by a film with a low recording level, or by too high a print density. Check such a film with one known to be good. See that the exciter light is correctly aligned and as bright as it should be.

Low sound may be caused by dust covering some part of the sound optical system, and this should be cleaned as previously directed. In exciter ray systems the lower end of the projector lamp must also be cleaned, as it often gets completely covered by dust drawn into the lamphouse by the cooling system. Other faults within the amplifier are extremely difficult to find, and their location is best left to an expert to find with the aid of proper instruments.

Sound Poor and Distorted

First try to locate the fault by careful listening. A crackling noise from the speaker usually indicates sparking somewhere, so look for a loose connection. If the sound has a "wow" to it, check the smoothing system and examine the lacing of the film. The crackling noise may also be caused by a faulty valve or by a valve not making proper contact. See that the prongs fit properly and are perfectly clean and free from oil. If necessary, clean them with No. 00 sandpaper, but wipe them afterwards.

Other causes of poor sound may be due to a faulty switch, a defective valve or exciter lamp, improperly fitted speaker-leads, metal objects adhering to the magnetic base of the speaker, a deteriorating condenser in the amplifier, or irregular speed of the projector drive, which in turn may be due to fluctuating voltage or failure of the automatic speed-governor. There are many other possible causes, and among which may be a faulty fuse or the radio set next door.

The faults listed above are the ones most likely to worry the beginner, but there are lots of other faults which may occur from time to time, which may be peculiar to the individual's own particular brand of carelessness or to the idiosyncrasies of his own machine. But all, or nearly all of these faults may be prevented by the operator carefully following the manufacturers' instructions on the use and correct operation of his equipment. And, refraining from the urge to experiment, as it sometimes takes two people to put the machine together again!

Within the Law

Entertainments Tax

THIS IS PAYABLE on charges of admission to any kind of entertainment, and is levied as a Duty on all payments exceeding a certain figure.

“Any kind of entertainment” is defined as being any or all of the following:—

- (1) A play or ballet.
- (2) A musical or vocal performance.
- (3) A cinematograph or slide exhibition.
- (4) A lecture or recitation in prose or verse.
- (5) Any exhibition of art.
- (6) Any other exhibition of industrial or scientific objects or processes.
- (7) Any exhibition of sport.

It will be seen that this list is one which covers every kind of performance where payment is made by the members of the audience for admission, but it does not include those cases where persons are charged an admittance fee in order to take part in the proceedings themselves, such as at a dance or whist-drive.

Exemption from entertainments duty may be claimed by certain societies or other non-profit-making organisations, but the exemption must be obtained in writing from the Customs and Excise, and received by the exhibitor prior to the programme.

Claims for exemption should be made in writing to the following address: Section 10, Secretaries' Office, H.M. Customs and Excise, City Gate House, 39-45, Finsbury Square, London, E.C.2, and forwarded at least two weeks before the date of the entertainment.

You are entitled to exemption from taxation if you are giving a show for charity or merely making a small charge to cover your expenses, but you must definitely apply for it just the same, and must not consider yourself exempted until the Customs people say so.

The actual payment of entertainment duty may be a considerable nuisance, but as H.M. Customs is now keeping an eagle eye on the doings of fly-by-night busking showmen, it may be as well to know how the tax is actually paid to the Government.

There are two methods of paying entertainments duty: By purchasing Government stamped tickets, and thus paying the duty in advance, and by making a declaration of your takings after the show.

The first method is far simpler than the second, but its obvious drawback is that you have to pay out a considerable sum in duty before collecting the takings. If you decide on the second method, first apply to the Customs and Excise for the proper form.

The Quota Act

Designed to foster and encourage British film production, the original Quota Act of 1927 contained a definite ruling that both distributors and exhibitors must handle a certain percentage of British films. This percentage was to be slowly increased in conformity with the gradual expansion of British production.

The Act was renewed in 1937, and ratified again in 1948. It concerns you because there is a very strong movement afoot to have 16-mm. included within its scope. This will mean that 16-mm. showmen will be compelled by law to show a certain percentage of British films, but if British films are not available in sufficient quantities to make the scheme workable, there is more than a possible chance that the Act will omit 16-mm. exhibition and distribution as before.

Home Office Regulations

These regulations deal with the safety aspects, location and construction of all places used for entertainment, and they are (sometimes) strictly enforced by the police irrespective of the fact that 16 mm. is not covered by the Cinematograph Act of 1909—



Fig. 33

This is one way of ensuring that your power supply is not turned off with the house lights. Just stick a piece of adhesive plaster over the switch you are using.

because 16-mm. film is non-inflamable, and this Act only applies to the exhibition and distribution of 35-mm. (nitrate) film.

The Home Office Regulations are quite lengthy and cover a host of subjects, but these are briefly summarised for the benefit of readers:—

(1) The building used for entertainment must be on an open space or by the side of a public highway, wide enough for a fire-engine to approach and yet leave room for the audience to leave.

If the building has seating accommodation for 250 people or more, there should be a second public way, or an open space of at least 250 sq. feet.

(2) If the show is to be held in a building with two or more rooms, the room chosen should have fire-resisting walls and ceiling. Entertainment must not be given in or above any room with a high fire risk.

(3) There should be at least two exits, and these must not be locked or obstructed during the time the audience is assembled. Turnstiles do not count as exits. There must be an exit within 55 feet of any part of the auditorium, and it must not open immediately onto a step or steps. There should be a landing of at least three feet. Exit signs are to be at least 6' 9" from the floor, and unless fitted directly over the exit, should include an arrow pointing to the nearest one.

(4) If the premises are regularly used for entertainment and have seating accommodation for more than 200 persons, the seats should be battened together in units of not less than four.

(5) Gangways should be at least 42 inches wide, and the seating so arranged that no seat is more than 12 feet from the nearest gangway running the length of the hall. People must not stand in the gangway unless they can still leave a width of 42 inches for others to pass by when leaving.

(6) All exits and gangways, all corridors or passage ways leading to exits, and all stairways and ramps for public use must be kept free from any kind of obstruction. Projectors and other portable apparatus must not be set up in front of an exit or in a gangway.

(7) There should be some form of safety lighting, of sufficient power to enable people to see their way out during the performance. A hurricane lamp may be used providing it is not placed against any inflammable material and is supported in a fixed position by chain or wire out of reach of the audience.

(8) Attendants should be trained in emergency duties (know how to use the fire-extinguishers, etc.), and at least one is required for each 150 persons. Twice the number of attendants are required if the audience is composed of children. (The girl with a tray of ice-cream does not count as an attendant.) If children are

accommodated in a gallery an attendant must be stationed at the top of each flight of stairs.

(9) Two fire-extinguishers or one stirrup hand-pump with two buckets of water must be provided for audiences of 300 or less. All equipment used for fire-fighting must be kept in working condition, and at all times be accessible for immediate use.

(10) The responsibility for the care of the audience rests with the person hiring the hall, and he is also responsible for carrying out the appropriate instructions contained in the Home Office Regulations.

The travelling showman should therefore ascertain beforehand whether the hall he proposes to hire is safe or otherwise.

The best thing to do is to find out beforehand if the hall is licensed for entertainment by the local Licensing Authority. If it is, he can be fairly sure that the condition of the hall complies with the Regulations, and he can go right ahead with nothing to worry about save the fact that the hall has no electricity, the villagers are working late in the fields, and the films have not arrived . . .

The Performing Rights Society

All gramophone records, and sponsored and other kinds of musical films may have two distinct copyrights:

(a) That of the music, for which a small fee is payable to the Society every time the music is played in public, and who thus look after the interests of the composers and others, etc.

(b) That of the record itself, public performance of which requires permission from the organisation known as Phonographic Performances, Ltd., but the Performing Right Society will give you all the help you need, and will let you know whether the music is covered by copyright or not and what the fee will be. The fees are usually quite small.

Sunday Shows

There are still a number of districts where it is forbidden to show films on a Sunday, and where the Sunday Observance Act of 1781 is still in force. The Local Authority may also introduce a number of Bye Laws affecting film-shows, so inquire about these at the Town Hall.

Other Restrictions

No alcoholic drinks may be served at any place during a public film-show, but if the show is private and not for the general public, the audience can drink as much as they like. But remember that it is positively dangerous for the operator to drink when on duty.

Do you read your film catalogue? You may find that some of the films listed may not be shown to the public, or that others may not be exhibited within two (or five) miles of a static cinema. Don't slip up on this, otherwise you are likely to be blacklisted in the future.

If you are giving a show at home, you can forget all about rules and regulations and do as you please; within reason, of course.

11

For The Educationist

Production

THE MAKING of an educational film requires more than just the skill of a good studio director.

The film must conform to certain standards in Teaching, and its subject matter must be what the teacher wants, and the only way to achieve this is by allowing the teacher to co-direct the film.

Neither the teacher nor the director is capable of producing a good educational film without the help of the other and their continuous co-operation is therefore a necessity. Merely to employ a teacher as a technical adviser for each production is only a half-way measure. (British studios are training teachers in production methods—an admirable idea.)

An educational film should be made for the specific purpose of imparting knowledge to a certain age-group or class, and it should impart this knowledge in a manner readily understood and appreciated by them.

The film should also deliver its message at a certain speed—the speed at which the age-groups are capable of assimilating the knowledge conveyed to them by visual aids. Unfortunately, the presentation-speed of many educational films has been overlooked in pandering to the art of presentation, and when this occurs a belated decision must then be made as to the most suitable age-group for the film—a totally wrong procedure.

It is obvious, therefore, that all these films must be planned according to the various needs of different age-groups and classes, and that in this planning the teacher must take his place alongside the studio director. This is not a question of sentiment, and neither is it an argument calculated to give the

teacher a say in films. Instead, it is a straightforward demand for universal recognition of the teachers' position in each production, and an urgent call for closer co-operation between the schools and the studios.

The need is not for stupendous productions, but for good films which may be used as an aid to teaching.

Before choosing an educational film for a specific age-group the teacher should first view the film himself, and at the same time examine its content in relation to certain standards necessary for the progressive education of the class.

It should be noted that any films reviewed and passed as suitable for any particular class must be reviewed again at the end of each term, for the needs of each class will vary according to the educational progress made, and the films which may be suitable this term may be totally unsuitable for the children next term. The standards set for the different age-groups should therefore be extremely flexible and always subject to revision.

The standards will also vary from school to school, and no text-book should be used to provide standards for any particular class or age-group—the filmic requirements of Class III at Bersea School will not be the same for Class III at Hillside, in spite of the fact that the age-groups in both classes are identical.

A guide to such standards may be obtained by studying the following questions—questions which should be asked concerning a specific film reviewed for specific use by a certain class:—

Is the commentary such that it may easily be understood by the children in this locality? Are the spoken words within the children's vocabulary?

Is the subject matter presented in conformity with intelligence-level of the class?

Is the presentation speed too fast? Should some scenes be longer?

Is the subject matter of the right amount? Not too much or likely to cause confusion?

How much knowledge of the total conveyed will be of benefit to the class? What percentage is too advanced?

What parts of the film should be elucidated by the teacher? After the film, or during its progress?

Does the film require a lengthy introduction by the teacher?

As the film is in colour, what should be done to assist those

children who are colour-blind? Does the filmic message depend on colour?

How much time will there be for discussion after screening the film?

What will be the probable reaction to the film?

Does the film teach the subject matter better than by any other means?

What does the particular teacher think about the film?

The Teachers' Needs

Films for classroom use should be of a certain length—a length governed by their subject matter. Most of these films are lovely productions, but the loveliness should not be allowed to dominate the subject. There is a limit to the amount of knowledge which can be absorbed by children within a certain time, and this limit should not be reached by amassing superfluities.

The films are usually presented by the teacher as part of and supporting a lesson previously prepared by him, and for this reason he should be allowed to view the film before having to use it in the classroom.

If a preview is not possible an alternative is found by providing the teacher with ample notes on the film, which should be sufficiently explicit and explanatory for him to plan his lesson without any subsequent interruption to its sequence. Teachers know that loss of interest means loss of knowledge, but conflicting subjects may also produce the same result. It is imperative that the teacher know the subjects portrayed by the film before he has to use it.

In some cases, however, a film may be provided containing a variety of subjects, and such films should therefore be provided with footage numbers. This would allow the teacher to screen only the subject required and without having to run through the whole of the film.

Many teachers suggest that the credit titles are a waste of time, and that they should only appear in the teachers' notes accompanying the film.

Coloured films are very much appreciated, but only if the colours are natural. Certain tints are misleading, and films which are completely coloured by one tint often call for an explanation by the teacher. The teacher should never have to

say "No, Henry, the sky is not really green—it's just the way they made the film." But this does not help Jackie, who made up his mind five minutes ago that the film is all about Greenland, and in spite of the fact that the commentator is talking about India.

Slides and film-strips should be printed in reverse colour for diagrams (white on black), as this will allow them to be projected onto the blackboard. The teacher may then add to them by using chalk if he wishes to extend the diagrams further.

There are many other requirements, but the list given above is of primary importance, and already made public by competent authorities.

Many teachers who are film-minded have already made considerable progress in the use of visual aids, and for many years prior to the war they were trying hard to get the authorities to recommend and supply the necessary equipment. But their efforts went unrewarded, for the few projectors which found their way into the schools were supplied by the local education committees, and in some cases even purchased by the teachers themselves.

Then came the war, and the use of visual aids was given terrific impetus through their adoption on a grand scale by the Services, and new machines were manufactured by the thousand and rushed to service establishments throughout the world.

And to-day? To-day the story is slightly different. "Still" projectors are to be supplied as standard equipment to all schools throughout Britain, and silent and sound projectors are recommended for those having 300 or 500 or more children respectively.

Outstanding among the progressives in visual aids are Britain and America, but reports of rapid progress are coming in from every part of the world, and many new records are being made for required expenditure on education in the various countries.

The British Government, realising that the rapid growth of visual aids calls for central planning and leadership, and knowing full well that available films and equipment must be evenly distributed throughout the whole country, has given its support to two new bodies created to serve schools.

These are the National Committee for Visual Aids in Educa-

tion, now concerned only with determining policy in visual education, and the Educational Foundation for Visual Aids, which handles the supply and distribution of all materials and equipment, plus information and maintenance facilities.

Although independent of each other, both organisations work in close liaison, and both are in constant touch with the Ministry of Education and with various trade and educational bodies.

The actual production of the majority of educational films is still in the hands of private producers, but they are now working in close co-operation with the Ministry of Education. Many of these producers were pioneers of instructional films at a time when Movies were a nine days' wonder and not to be taken seriously, but to-day their productions are eagerly awaited by teachers throughout the world.

Production is steadily increasing, but with their introduction in the schools it has been found necessary to evolve new methods in teacher technique, and of immediate interest are the recommendations recently made by the new National Committee—recommendations which strongly hint that the teacher must now fit himself for handling the new material.

Using the Tools

So now the teacher must learn; learn not only the mechanics of visual aids but also how to apply those aids. They are the new tools of education—they supplement the teacher, but do not supplant him. What shall he do to get the best results from the new material, and who shall teach him the correct methods for their application?

The answer, of course, can only be provided by experience and experiment.

There are no set rules to follow, no well-established procedure, nothing in fact, save a few recommendations and suggestions made by those whose experience is limited by their choice of equipment. But then, nobody can experiment with equipment which is not available, and nobody can tell us how to use the equipment now being planned for future use.

We are told that 2" slides may be the Standard slides of tomorrow, chiefly because they are readily prepared from film-strips and the latter are easily mass-produced.

In spite of this, however, the author believes that the 3½"

slide will remain in use for many years to come, and for the simple reason that there are already thousands of standard diasscopes now in daily use—a use keeping alive the demand and supply of the $3\frac{1}{4}$ " slide. But many owners are having their diasscopes adapted for the smaller slide, an unfortunate but necessary expense which has to be borne if the owners are to take advantage of all the slide material now available.

The chief advantage of the film-strip and slide is "selectivity"—it can pin-point a subject and display it to a class for any length of time. The disadvantages, however, are numerous.

The advantages of *cine* film are manifold, and its achievements in furthering education are not to be denied. It is the only satisfactory medium for illustrating "movement," and can illustrate it either by animated drawings or by photographic reproduction.

It can be designed to appeal to our emotions, and so produce powerful impressions calculated to stimulate the memory—a psychological phase in filmic education which calls for careful consideration by the planners. And teachers should note that the impressions made by films on a young child's mind not only depend on the subject matter, but also on the way in which the film is presented, and in some cases by *whom* presented. (A child who has just been punished by a teacher will probably not only dislike him, but his films as well!)

If we think of the film as just another tool (and rightly so) we must also think of the teacher as the craftsman who must learn how to use it properly. He must know its limitations as well as its advantages, but should also know when and where to exchange this tool for another without interrupting the continuity of a lesson.

As an example, the teacher may wish the class to look at page 279 in their history books, but instead of asking the whole class to find the desired page he simply places his own book (open at page 279) within the episcopes. He then points to page 279 showing upon the screen—he hasn't stopped talking, and he still holds the attention of the class. Also, he has not wasted any time, which would have been the case had he to wait for the class to find the page themselves.

This example illustrates only what is possible—not what can be done. The drawback to such technique is obvious, for the use

of the episcopo requires (to-day) a complete darkening of the classroom. So now we must also expect the planners to introduce controlled lighting for the schools of the future, an obvious requirement, but one which must not be neglected as it is at present.

The reader will probably be able to devise many novel and practical uses of the visual aids in his possession, but those who are teachers should seriously devote a certain amount of time to their application—excluding, of course, novel ideas likely to produce roars of laughter from the children.

We have mentioned teacher-technique, but look in vain for a text-book explaining that technique. It is up to the teacher to evolve his own. But even if such a book were available the teacher would still apply the technique in his own particular manner, and, dependent on his capabilities and temperament, the original technique might easily be changed to something entirely new.

Such a text-book, indeed, could only generalise, and could only present certain broad principles for the teachers' guidance, the interpretation and application of the principles varying according to the individual.

The procedure for classroom presentation of films will also vary according to the nature of the film in use, and we can only generalise if we attempt to explain how they should all be shown. But here is a brief description of the usual rules generally adopted for the screening of films:—

(1) Assuming that the teacher is thoroughly conversant with the subject matter, he should first introduce it to the class, telling them what to expect, what they should look for, and what they should attempt to memorise.

(2) The film is screened as part of a lesson, and it should not be left to convey its message without the teacher ensuring that the message is being properly received. The reactions of the children should also be studied, and parts of the film requiring explanation carefully noted.

(3) Immediately after the film the class should be questioned or engaged in discussion—the teacher thus ensuring that the subject matter will be memorised by them.

(4) A second film should not usually be shown immediately after the one proceeding it, as this may easily cause confusion,

and thus prevent the class from remembering the essentials of either.

(5) Films shown during school hours should count as part of the normal lessons, and should never be permitted to interrupt or deprive the children of morning or afternoon "games." Action on the films must not replace action by the child.

(6) The teacher must be appreciative of the many uses of visual aids, and should not regard the educational film as something which supplies a break from normal routine in the classroom. The film is now *part* of the normal routine.

To conclude, the teacher must be more than just a projectionist. He must be a craftsman, and learn how to use all the tools which may be given him, and whether they range from a "T"-square to a television set, he must know how to get the best from each.

12

Some Modern Equipment

THIS CHAPTER briefly describes a number of modern projectors and some allied equipment, but although the list is not a complete one of all the machines now available, it is representative of the equipment now in use or about to be used in Britain. The list is also fairly representative of both the expensive and relatively cheaper models, and it is hoped that the reader will gain in knowledge from their functions and descriptions now explained. But first we must mention that new machines are coming onto the market so fast that it has been impossible to list them all, and a number of perhaps equally good machines have been omitted.

Quite a few new projectors have made their appearance since this book was started, and sections of the book have been re-written in order to bring the instructions up-to-date.

A large number of new devices and accessories have also made their appearance in recent years, and some of them are reviewed in this chapter.

Among the new machines are some with new devices and of revolutionary design, whilst others are so simply constructed that it would seem that nothing could be easier than to set them up and operate them without instructions. Among the latter is a new machine which *cannot* be operated the wrong way—if you do the wrong thing nothing will happen, it's as simple as that. And the plugs and attachments can only be put together the right way. But do not skip this review, for the descriptions are purposely designed to give the reader further instruction.

Among the new inventions are some destined to make 16 m.m. shows of the future every bit as good as those at your local cinema.

The Tungsten Arc

Still holding first place among the many inventions of recent years is the compact-source lamp marketed by B.T.H. Known as the Mazda Type-ME, it has an arc of tungsten in mercury vapour and a bulb of quartz instead of glass.

Those now widely used are of only 250 watts, but the light produced by them is far in excess of that produced by 1,000-watt filament lamps. The life of the new lamp is also greater than any filament lamp—500 hours, as compared to only 30 hours for the latter.

For those who wish to incorporate the lamp in their own machines with the minimum of work, it is supplied already mounted within a special cylindrical cover and with a standard pre-focus base, which in most cases will allow it to be inserted in the lamphouse without too much trouble. Your reflector will not be needed and can be removed if it is in the way. But however you carry out the adaptation, the following precautions must be taken:

1. Stray light from the lamp must not be allowed to shine outside the projector. This is because the lamp produces a certain amount of ultra-violet light, which in time could make things rather unpleasant for the operator. To guard against such an eventuality, the lamp should be kept within its special casing. But there is no danger from the light transmitted by the lens.

2. The lamp should not be removed until it has cooled down and thus reduced its internal pressure. This is to guard against the (rare) possibility of it exploding.

Besides the above precautions, an adaption will also include some method of preventing flicker. The lamp strikes 100 times per second when working on A.C. 50-cycle mains and thus produces a slight but noticeable flicker, but as we mentioned in a previous chapter, this is easily overcome by running the projector at 25 frames per second, or by making a slight alteration to the setting of the shutter. But in spite of any such disadvantages, no-one can ignore the very real benefits possible by its adoption. It has a longer life and is therefore cheaper to use, and no other lamp yet made available to small-gauge users can produce such brilliance.

An even more powerful lamp, however, is now produced by the same company—a lamp which will give better colour-

rendering, and for those who want it, even more light. Your local cine dealer should be able to give you further information if you require it, or you can write direct to the British Thomson-Houston Co. Ltd., Rugby, England.

Magnetic Recorders and Reproducers

The Cine Soundmaster, manufactured by Scophony-Baird Ltd., will allow you to convert your silent projector to sound within a matter of minutes.

The outfit consists of a recording/reproducing unit, plus a loudspeaker, microphone and a flexible cable which connects the machine to your projector.

The sound is recorded magnetically upon a steel tape or a tape of film carrying a coating of magnetic substance. The tape can be used to record sound lasting over an hour; it can then be rewound for an immediate playback of the sound or the sound can be erased and a fresh recording made at will.

A special erasure fitment (wiping-head) permits the same tape to be used as often as it is required.

The value of such a unit, especially to the amateur film maker, is at once made obvious when we consider what can be done with it. The owner of a silent projector, for instance, will be able to hire a "sound-tape" or record his own sound to go with any particular film. Or, if he wishes, he can have the unit adapted to his projector so that it becomes, in effect, a sound projector.

The Soundmaster also contains facilities for recording sound from two sources at once, thus permitting you to make a commentary with, for instance, a background of music or "effects".

Details of the latest designs in similar equipment may be had by writing to Scophony-Baird Ltd., Lancelot Road, Wembley, Middlesex.

A Transportable Proscenium

Every film user will admire the complete proscenium outfit marketed by the Breckland Cine Service. Known as the "Pylon", this unit consists of a transportable cinema proscenium in miniature—motorised draw-curtains of silk, 3-colour light-changing effects, dimmers, and a panel of controls attached to a special projector-stand.

The entire outfit may be erected or dismantled within a few minutes, and for transportation it is packed within a special case measuring 10' x 14" x 10". These dimensions are for the 8' x 6' size screen, but the Pylon can be supplied in whatever sizes are needed.

The control-panel includes switches for 2-way variable-speed curtain control, for the dimmers which work the light-banks, and for colour-control and pilot light. There is also a special 8-core cable connecting the unit to the panel. As an aid to good presentation designed specifically for the road-showman, the Pylon is probably without equal. Readers requiring further information on this and similar units are invited to write for an illustrated brochure to the Breckland Cine Service, 10 Bridge-street, Thetford, Norfolk.

The Drum Loop Absorber

The advantages of the film loop for easy repetition of short instructional sequences have already been mentioned, but a retarding factor in its wider adoption has been the problem of handling a loop of any appreciable size. Loop absorbers are used to accommodate the free portion of the loop during projection, but so far the size of loops capable of being handled has been limited to a maximum of about 30' of film.

Educationists will therefore appreciate the Drum Film Loop Absorber newly designed by Sound Services Ltd., and now being marketed by that organisation. The following are the chief points of its design:—

1. A loop up to 70' long is fed from a magazine of only 6" in diameter, which is mounted on top of the projector in the place of the normal spool-arm. Another arm carrying a free-running guide-roller also takes the place of the normal take-up arm. (70' feet of film lasts for two minutes at sound-speed and three minutes at silent-speed—16-mm.).
2. The changing of loops takes no longer than the time necessary for the normal threading of the projector.
3. There is actually less tension on the film than from the normal feed-spool.
4. No modification to the projector is necessary—it is supplied with a specially designed attachment for each type of pro-

jector. And the loops, of course, can be stored in the usual 400' cans.

The address for further enquiries is: Sound Services Ltd., 269 Kingston Road, Merton Park, London, S.W.19.*

A Draw-curtain Unit

This is not a complete proscenium by any means, but it does allow the user to provide some of the essentials of showmanship at a reasonable price. The 'Showmaker' Draw-Curtain Unit, for example, has no cords or pulleys, and the mechanism is completely enclosed in one compact and very portable unit which can be erected or taken down in a few moments.

A remote-control box is supplied complete with an ample length of cable, enabling the curtains to be controlled by the operator when standing next to his projector. The controls include an automatic device which permits the curtains to be stopped in either the open or closed position.

The curtains are drawn silently along a single rail and the whole outfit is supported by unobtrusive fittings which have been so designed that they can be attached to a wall or even to a window.

The Showmaker is suitable for home cinemas having screens 3' to 4' wide, but larger units can be supplied to meet specific needs. An illustrated folder may be obtained from the makers: Brown of Bristol Ltd., 35, St. Stephens-street, Bristol 1.

The Amprosound Premier-20

Stimulating interest in sound-on-film 16-mm. projectors for home use, as well as for classrooms and factories, is the new product of the Ampro Corporation of Chicago. The Premier-20 is precision built for professional use, and the British model, made by Kelvin, Bottomley and Baird, Ltd., closely follows the American design. It is sturdy, compact, easy to operate, and has an amazingly quiet-running mechanism.

The extremely simplified design includes a new swing-out gate for easy inspection and cleaning of the aperture plate and pressure shoe—a job which may be done in a matter of seconds and without disturbing the focus of the projection lens.

The Premier-20 is equipped for both silent and sound film-speeds and for reverse operation, and the switches are readily accessible on a centralised control panel. The machine is sup-

*The address for test -films.

plied with a "Super" lens with bloomed finish, F:1.6 two-inch as standard equipment, and easily replaceable with other lenses of various sizes in focal length.

Illumination is provided by standard lamps of 750 or 1,000 watts, and although these lamps are prefocussed, provision is made in the Premier-20 for extra micro thumb-screw adjustment—an added refinement much appreciated by professional users. The spool arms are permanently attached and made to accommodate spools of 2,000' capacity. There is also a still-picture device, and an automatic fire-shutter which comes into operation should the motor slow down or stop, and which obviates the possibility of the film blistering.

Cooling is provided by a powerful centrifugal fan which not only cools the lamp and inner optical system, but the amplifier and motor as well.

The triple claw movement is extremely smooth in action, and as three sprocket-holes are engaged simultaneously there is little chance of losing a loop, and good shows are therefore possible even though the film may be extensively damaged.

Threading is actually easier than it looks, and an important time-saving factor is the fact that both sprocket-shoes open and close automatically as the film gate is operated, and a handy pilot-lamp facilitates threading in the dark.

Rewinding is fast and automatic, and speedily accomplished without having to transfer spools or belts. There are also handy controls for framing and for tilting the projector-head.

The removable front and rear covers facilitate servicing, and both the reflector and condenser lenses are mounted on the front cover for speedy cleaning.

All parts which actually touch the film are specially designed to prevent scratches to the picture or sound-track, and a feature of the film path through the sound-head is the provision for side tension on the sound-track side, and an even pressure-feed tension on the sprocket side. The film is practically "nursed" through the projector from feed to take-up, and it is obvious that the whole machine has been carefully designed for both projection and the care of film.

The sound drum and filter are mounted on precision roller bearings, and there is no sliding action between the drum and the film, thus prolonging film life and maintaining high quality

sound. The curved film guides before and after the sound drum eliminate weaving or "belt action."

In the sound-optical system, light is directed from a pre-focussed exciter lamp directly through semi-cylindrical lens, eliminating the usual mechanical slit and mirror.

The sound output is rated at 15 watts, and is reproduced from a 12" permanent magnet dynamic speaker. Reproduction is crisp and clear, and the tone is particularly pleasing to one accustomed to 16 m.m. sound.

The projector is attractively finished in bronze, and is delivered complete with lens, lamp, speaker, accessories and new luggage-type carrying cases.

Wholesale distribution in Britain is by Simplex-Ampro, Ltd., of 167-169, Wardour Street, London, W.1, and readers are invited to write to them direct should they require further information or the current literature. The company will also be pleased to assist owners of existing Ampros for the supply of spare parts and instruction books, providing that the latter are still obtainable. Some Ampro models have been obsolete for a number of years and therefore such literature may not be obtainable now.

Voltage—105-125 A.C. Use a transformer with A.C. 230-volt mains, and connect a 150-watt Converter for D.C. to the amplifier. The motor is universal, but the amplifier is for A.C. ONLY. Total power consumption is approximately 1,350 watts.

The Ampro "Imperial"

This silent projector is one of the best of the post-war models. It is light, compact and portable, and has every feature of the "ideal projector"—greater simplicity, longer service, and lower operating cost.

The Imperial is quite easy to set up and operate. All the owner has to do is unfold the spool arms, then thread the film and start.

The "still" picture-button permits stopping at any frame indefinitely, an automatic safety-shutter preventing the film from burning or blistering. The reversing-switch may be used without stopping the motor, and a new fast automatic rewind-device obviates the usual changing over of spools. Threading is sur-

prisingly simple, and the film is laced at only three points—two sprockets and the gate, and there is plenty of “finger-room” for the “ham handed.”

Apart from all the other niceties to be found in the Imperial, many users will consider that the most important feature is the single row of sprocket teeth, which allows the projection of sound films as well as silent ones. (Sound films must not be used on other machines fitted with two rows of sprockets.)

The gate mechanism includes a new triple-claw movement, which engages three perforations simultaneously and ensures a perfect feed even when two or three consecutive perforations are damaged.

Illumination may be provided by any standard projection lamp of 750 watts or less, and as with all Ampro models, the entire optical system is precision-engineered for maximum brilliance. Film capacity is limited to the standard 400' spool, but if the owner thinks it necessary, 1,600' spool-arm conversion kits can be supplied as an extra.

Other features include a tilt control-knob for moving the projector-head up or down, a swing-out gate, and automatic sprocket-shoes which open and close when the gate is operated. The shoes may also be operated individually when adjusting loops, etc. A 2" coated projection-lens is fitted as standard, but this can easily be replaced by others of various focal lengths when required.

Alignment of the projection lamp with the optical system is provided for by an extremely micrometric adjustment control, and the projection lens is focussed by gently turning it within the lens mount.

Both the motor and mechanism-drive are entirely enclosed, and the former, with its greased-sealed ball-bearings, requires no attention by the operator. Lubrication is also simple and efficient, and is fed by central distribution to the high-speed shafts.

Film speed is governed by a rheostat-type control, which allows projection at any speed within the normal range.

The Imperial is also fitted with a pilot-lamp for easy threading, an excellent framing device, and a powerful fan for cooling the lamp and gate area. It is supplied in the new luggage-type carrying case, and the accessories include a 400' spool, 2" coated

super lens, lamp glove, a bottle of Amproil with an "applicator," a cleaning brush and an instruction book. Standard finish is in bronze, with chrome and stainless-steel fittings.

It is distributed in Britain by Simplex Ampro, Ltd., of 167-169, Wardour Street, London, W.1.

Voltage—The Imperial is designed to operate on both D.C. or 25 to 60 cycles A.C., 105 to 125 volts. A step-down transformer must be used when connecting to 230 volts A.C. mains, and a resistance, or convertor *and* transformer, when connecting to 230 volts D.C. mains.

Bell and Howell-Gaumont Model 601

Model 601 is the latest contribution from two world-famous companies who have combined their skill and experience to make this an outstanding projector—Bell and Howell of America, and Gaumont-British of Britain. The net result of this Anglo-American co-operation is a masterpiece of streamlined engineering incorporating many original and exclusive features.

The whole outfit comprises two well-matched carrying cases in which are contained the projector, amplifier, spool arms, spare belt, oil-can, cleaning-brush, etc. (small case) and the loud-speaker, mains and speaker-leads, spare tool and accessories (large case).

The amplifier is built-in in the base of the projector, but can easily be removed without having to take the projector out of the case. Recent improvements provide complete protection against humidity damage, and the amplifier is "floated on rubber" to minimise damage from jarring. Fidelity of reproduction is assured by the "negative feedback" principle, resulting in balanced reproduction of low, medium and high frequencies without distortion. Self-compensating circuits are also fitted to eliminate any need for adjusting the supply to the photo-cell.

Radio interference is ruled out by the specially designed and built-in eliminator, thus obviating any possibility of crackle or distortion. It is thus possible to use silent films with a radio background, knowing that there can be no hitch involving sound.

The controls, all placed for speedy operation and "natural movement" by the operator, provide all the essentials for professional exhibiting. Both tone and volume controls are exceptional, the former amply modifying tone for film, mike or non-

sync., and the latter smoothly controlling volume throughout the frequency range by a new "stepless" movement. The switches, all plainly marked, are for lamp, motor, sound/silent, and reverse/forward movement. There is also a pilot light which lights-up automatically when its casing is pulled forward, the case shielding the light from the face of the operator.

A special feature of this machine which should be noted is the unusual but highly efficient smoothing system. Known as the Oscillatory Stabiliser, it consists of two rollers which are free-running yet ingeniously interlinked, and so arranged that the film is smoothed both before and after it has passed over the sound-drum. The system ensures unvarying film-speed at the point where the film is scanned, thus completely eliminating 'flutter'.

The removable spool-arms are carried inside the projector case (the blimp), one on the door and the other at the rear of the case. Both are fastened by thumbscrews accessible when the upper large door of the blimp is opened. Film capacity, governed by the size of the spools which can be accommodated, is up to 2,000 feet.

At the end of the rear spool-arm is the combination mechanism for both rewind and take-up—extremely simple yet highly efficient. No adjustment or compensation is necessary for various spool sizes, since the flat fabric belt between the two pulleys provide complete and automatic compensation without any manual adjustments.

Although a 750-watt prefocus lamp is supplied as standard, any Class A1 projector lamp up to 1,000 watts may be used in perfect safety, but note that the lamp's base-flange is of a special type for the Bell and Howell range of projectors. The flange (or lug) is fitted with a flat guide-pin, which ensures that the lamp is always correctly inserted without fumbling for the right position. Cooling is provided by a powerful "blower," which keeps not only the lamphouse and gate-area at the right temperature, but also the amplifier as well.

Another well-designed feature is the still-picture device, which is manually operated when it is desired to arrest picture movement. It is really a clutch, and when it is actuated it disconnects the mechanism from the main drive. To prevent the film from heat-damage, a perforated metal safety-shutter (which never re-

quires cleaning) drops down in place behind the aperture—an automatic movement which takes place each time the mechanism is stopped.

The optical system is equally efficient, and has obviously been carefully designed for maximum illumination and definition. The lenses are, of course, specially coated, the objective being speedily interchanged with 2" ones supplied as standard.

There are many other refinements, but space forbids a complete description of them all. The author must therefore confine himself to a further brief statement of fact—which is that the Model 601 is one of the best 16 mm. sound projectors yet produced, and he'd very much like one for a Christmas present.

Model 601 is distributed in Britain by G.B. Equipments, Ltd., Imperial House, 80-82, Regent Street, London, W.1.

VOLTAGE—200/250 A.C. using a step-down transformer. For D.C., use a rotary convertor. But check your "Owner's Manual" first.

B.T.H. Type-301 Projector

This new 16 mm. projector is designed on the unit principle for simple and speedy servicing, and complete sections may be removed and replaced quickly when necessary. The entire intermittent mechanism, including the gate, shutter, etc., may be withdrawn as a complete assembly—a simple operation easily performed. The amplifier forms another complete unit, and is just as easily replaced.

Maximum screen illumination is provided by a new type 500-watt or 750-watt projection lamp coupled with the latest optical system having surface-treated (bloomed) lenses, and an aspherical mirror. A fast "pull down" time plus a relatively narrow-bladed shutter ensures that a maximum amount of light reaches the screen, and the result is a picture of surprising brilliance.

The objective lens normally supplied is a 2" F.1.65, but others of various focal lengths are available when required. All, of course, are "bloomed" for maximum efficiency.

A single driven sprocket, wide-opening gate, and a quick threading lever, gives the simplest threading yet devised, and a novel spring-loaded two-claw intermittent mechanism ensures a rock-steady picture. The gate is also provided with delicately spring-loaded skids of stainless steel, making "thread-

ing in frame'' unnecessary and minimising the possibility of damage to the film. The arrangement also lowers the rate of normal wear of both machine and film.

The spool arms are built-in and of the folding type, and are made to carry spools up to 2,000' capacity. The take-up is of original design, and provides automatic compensation for the increasing diameter of the spool during projection. Rewinding is power-driven, and actuated by moving a handy lever.

Provision for lubrication is made easy by the single oiling-point, and the projector is fitted with grease-packed ball-bearings throughout.

The sound from the 301 is exceptional, a completely new amplifier giving 8/10 watts output with minimum distortion.*

Valves are easily accessible, and may be removed by first removing the projector cover. Faithful reproduction of sound is made possible by an extended frequency response, and the single tone-control provides adequate compensation for poor recording and bad hall acoustics.

The sound optics are provided with a speedy "snap over" device for correct sound focus when using either monochrome or coloured films.

A well matched loud-speaker is built into its own carrying case, and the latter, besides acting as a baffle, is used to house the 50' of speaker lead and a spare spool. The speaker has a 12" base and is of the permanent magnet type.

All controls are grouped to one side of the machine, and include a quick acting device for tilting the projector, and a screw adjustment for focussing. Sound and silent film-speeds are selected by using the appropriate switch, and a very efficient A.C. capacity motor entirely eliminates speed variations and commutator troubles.

The cooling system is another excellent feature—a dual forced draught ensuring that both the amplifier and mechanism are amply cooled and the temperature kept well within safety limits.

Type-301 is now being distributed throughout the country, and most cine dealers should be able to arrange a demonstration or supply the reader with further information. In case of difficulty, however, you may apply to The British Thomson-Hous-

*All amplifiers produce *some* distortion.

ton Co., Ltd., Rugby, or Crown House, Aldwych, London, W.C.2.

Voltage—90 to 270 volts, 50 cycles A.C. mains. Use a rotary converter when operating on D.C.

The Carpenter

This projector is very similar to the American "Natco" machine, and is being manufactured in Britain by Carpenter & Richardson, Ltd., of Wembley, a well known firm of precision engineers.

The Carpenter is a "truly professional" model, and is fitted with all the usual controls so designed to give the operator a certain advantage in the way of "slickness" and showmanship. A most unusual feature, however, is that the operating-side of the projector is on the left. The sprockets are thus placed on the inside, away from the operator, and permit the film to be threaded without the surface being scratched—always a possibility with right-handed threading.

Designed on the unit principle, complete assemblies, such as the intermittent movement and the amplifier, may be speedily withdrawn and replaced, a job necessitating no more than the removal of one or two screws and easily accomplished by the novice.

The triple-claw action is extremely smooth and quiet. The claws engage with a sliding-movement three perforations at a time, and there is little danger of loss of hoop.

Illumination is from a 750-watt lamp set at right angles to the gate, and the light is reflected by an inclined mirror through double condensers to the projection lens. Lamps of either 500 or 1,000-watts may be used as alternatives. A 2" F.1.6 bloomed lens is fitted as standard, and others of various focal lengths may be supplied when required. The lamphouse is so constructed that a defective lamp may be swung outwards and speedily replaced within two or three seconds, the new lamp being automatically positioned when the housing is swung back into position. Picture brilliance is exceptionally good.

The Carpenter is also fitted with two motors; one to drive the mechanism, and the other the rewinding-device and blower. Both are high-speed synchronous-type A.C. motors. The movement of the reverse-switch disengages the take-up from the main

drive and re-engages it automatically with the rewind mechanism. There are facilities for both sound and silent film-speeds, for one-hand tilt-control of the projector-head, and for simplified framing and focussing. There is also a voltmeter positioned just above the lens mount, and a new still-device.

The lubrication system is also simplified, and a single oiling-point is used for central distribution. Motor-bearings are grease-packed, and other bearings are of the oil-less type.

Spools holding 2,000 feet of film may be accommodated on the folding arms, and the take-up is provided with automatic compensation.

The sound from the Carpenter is excellent, and there are separate tone-controls for both high and low frequency attenuation, besides the other knob which controls the volume. The output is ample for any audience up to 2,000 in number, and a well-matched loud-speaker, fitted within its own carrying case, gives faithful response without the slightest trace of "flutter" when working on full volume. It is of the 12" moving-coil type.

Direct scanning is provided within the soundhead, and a revolving sound-drum, together with a new smoothing sprocket-wheel, ensures a uniform speed of the film past the scanning beam. The latest type of exciter-lamp is also incorporated, which works on a supply of 6 volts at 15,000 cycles produced by a thermionic oscillating valve and received by the lamp via a transformer.

The threading of the Carpenter may appear a little awkward for those using it for the first time, but it is nevertheless designed for easy manipulation, and after a little experience the operation of threading should not take more than a few seconds.

The projector, loudspeaker and mains-transformer form three separate units, the first two weighing 63 lbs. and 23 lbs. respectively. Cables supplied consist of 50 feet for the speaker and 10 feet for the mains. The projector is robust and of heavy-duty construction, and most of the smaller parts are either of stainless-steel or chrome. Altogether, the Carpenter is a model which fully reflects the makers' experience in precision engineering.

Voltage—For A.C. mains only, using the mains transformer supplied with the equipment. A rotary convertor must be used when

connecting to D.C. mains.

Further information may be had by writing to the Sales Department, Carpenter & Richardson, Ltd., Beresford Avenue, London, N.W.10.

The Debie D.16

Operators using this machine for the first time will get two very pleasant surprises—the excellent reproduction of sound, and the unusual quietness of the mechanism.

The D.16 is manufactured in Britain by Cinetech Ltd. The Company's claim that the machine is precision-engineered is a very modest one, for the new specially designed mechanism is so quiet in operation that it is hardly audible above the gentle hum from the motor; thus obviating any necessity for a blimp, and allowing the projector to be used in close proximity to the audience without distracting their attention.

Compared to some projectors, the new Debie appears at first glance to be something prepared for the novice, but a second look is quite sufficient to make us quickly revise this opinion.

The machine is constructed from self-contained units all of which can readily be removed for inspection or servicing:

The "gentle hum" we mentioned comes from a new type 1/15 h.p. constant-speed motor, which is set within a shock-proof coupling at the rear of the lamphouse. It is so designed that you can take it out and dust it whenever you feel like it, a job which only takes a few seconds.

A convenient switch allows a 750-watt lamp (for example) to be operated at a lower voltage to equal the brilliance of a 500-watt lamp, thus lengthening the life of the former. A powerful blower-type fan provides adequate cooling within the lamphouse, and an unusual feature is that the lamp cannot be switched on unless the fan is working, thus minimising a form of film damage.

The intermittent movement consists of a new smooth-action triple claw perfectly synchronised with the single-bladed shutter—the latter so made that it requires no adjustment by the operator. A steady picture is ensured by correctly balanced pressure rails within the gate, the latter made to swing out through 90 degrees for easy cleaning and rapid servicing. Other contributory factors to the quiet running of the projector are the shaft-driven

sprocket-wheels and spindle-driven take-up, and to the fact that there are no internal belts or chains.

The spool-arms are quite sturdy and rigid, and are designed to carry spools of 1,800 feet capacity. They may be folded back into the machine when not in use.

The oil supply for the lubrication system is clearly visible within a perspex container mounted on the top of the machine. The rate of flow is fully adjustable.

Light for the sound-system is provided by rays picked up from the bottom of the projector lamp. A readily adjustable prismatic condenser lens on the top of the sound optic unit is provided for compensating differing positions of lamp filaments. A unique feature is the accessible and readily removable sound drum for cleaning the optical system. Constant speed of the film through the soundhead is ensured by the heavy but perfectly balanced flywheel, weighing $4\frac{1}{2}$ lbs. and measuring $5\frac{3}{4}$ inches in diameter.

The amplifier is constructed as a separate unit and is housed in the base of the projector, and from where it may be withdrawn by merely removing a few screws and then lifting the projector upwards and away from it. The sound output is unusually high for a 16-mm. projector—25 watts; but this is something we have often wished for when forced to use a print with a very low recording level. The amplifier is a 5-valve 4-stage job, with pentodes in class "A" push-pull output-stage and negative feed-back incorporated. Separate top and bass tone-controls are also provided, and both speech and music are perfectly reproduced without any of the usual blurring of extended frequencies. A number of speakers may be used if required.

Threading is made extremely fast and simple by the whole layout of the film track, the film being guided by semi-circular channels towards and over the sprockets, and the bottom loop formed automatically. There are no spring rollers to cope with.

The controls are grouped together on a panel on the operating side of the base, and inputs are provided for microphone, non-sync, or for a monitor speaker or headphones. The loud-speaker is of the permanent magnet type, and a 12" speaker is supplied as standard with the machine. The speaker cable is of 75 feet, and when not in use is kept within the speaker carrying case. A socket is provided in the speaker case for connecting an additional speaker.

Supplied with and forming an integral part of the equipment, the new projector stand, besides being a perfect match for the projector, is actually one of the best stands obtainable. It consists of a tubular structure supported by three independently adjustable feet, and the platform may be swivelled or tilted in any direction. The feet, quickly adjustable to an uneven floor by means of the handy thumb-screws, may also be permanently attached to the floor for static use.

The D.16 is now widely distributed throughout the country, but should your cine dealer not be able to help you, the makers will be at your service.

Address your letters to Cinetechnic, Ltd., 169, Oldfield Lane, Greenford, Middlesex.

Voltage—The D.16 operates on 110 volts A.C. 50 cycles. Use a mains transformer when connecting to 230 A.C. For operating on D.C. a rotary convertor must be used.

The 8-mm. Dekko Model 118

The Dekko-118 has been designed to provide 8-mm. users with a very high concentration of light, and its quietness and simplicity have to be experienced to fully appreciate it.

It will produce a brightly lit picture 3' wide at a throw of 18' when using the 1" lens. The 1" lens, by the way, has been chosen as standard because it has been found to give the best results when used in the home. Other lenses, which are available as accessories, can be obtained in the following sizes: $\frac{3}{4}$ ", $1\frac{1}{2}$ " and 2".

The size of the picture can be varied, of course, by using the appropriate lens. The picture-size will be reduced by the $1\frac{1}{2}$ " and 2" and increased by the $\frac{3}{4}$ " lens.

A suitable lead has to be connected to the mains supply and to the mains input plug, which is fitted with an earthing connection for use with a 3-core cable.

In appearance, the projector forms one compact unit, but all working parts are readily accessible by removing the large covers. Controls are for the lamp, motor-speed, framing, tilting, and, believe it or not, for controlling the room lights. This is made possible by the special input for a lead from any table-lamp or lamp-standard, etc.

The projector lamp is a standard prefocus compact-filament

type operating on 110 volts, which may be used on 230-volt mains providing that the integral resistance-unit is used.

Heat generated from the lamp and resistance is carefully insulated from the film and dispersed by a forced air-cooling system. The claw-movement includes modern improvements and has a very fast pull-down time, and the simplified gate makes threading quite easy.

The Dekko is marketed under three different model numbers: 118-A, 118-B and 118-C. Models 118-A and 118-B are suitable for 500-watt lamps, and Model 118-C for lamps up to and including 750 watts.

Readers requiring information on the Dekko range of equipment and accessories are invited to write to Dekko Cameras Ltd., 19 Telford Way, East Acton, London, W.3.

The Kodascope Eight-45 (an 8 mm. Silent Projector)

Simplicity of threading, a minimum of controls easily located even in darkness, simple change from projection to rewind—these are some of the salient features of the “Kodascope” Eight-45, which follows in general mechanical design the popular and trouble-free Home “Kodascope” 8, but with higher-power lamp, wider aperture lens, and silver (antique) finish.

Reliability is assured by the use wherever possible of die-castings and machined components, rather than of pressed-metal assemblies. The F-1.6 Kodak projection lens, with 300-watt lamp, combined with the optical design of reflector, condensers, and shutter, together ensure maximum light output. A “plug-in” internal resistance makes possible its use on any electrical mains supply from 100 to 250 volts. Effectively earthed, it is supplied with an ample length of 3-core rubber-covered lead; it conforms to all of the usual electrical safety regulations.

The mechanism has been considerably simplified, and consists of three essential shafts only. There are no internal chains or wire belts. The complete projector is supplied in a stout cardboard box, with a full range of the necessary accessories.

Altogether, the Eight-45 is a sturdy and compact projector likely to please any 8 mm. film user, for it is obviously a machine which, although specially produced for the person of moderate income, has yet been designed and manufactured to the highest professional standards.

Readers in Britain are invited to apply to the following address should they desire further information:—Kodak, Ltd., Motion Picture Film Dept., Kodak House, Kingsway, London, W.C.2.

The 9.5-mm. Pathe 'Ace' Projector

This popular projector is the smallest and least expensive of the Pathescope models, and its selling price is just over £5. It is basically little more than a toy, but this does not mean that it has been 'cheaply' made. To start off with, it is solidly built with high-pressure castings, and its optical system has been designed on the best cinematographic principles.

The Ace is fitted with a 3-blade shutter and is remarkably free from flicker. There are two models: One is a transformer machine designed to operate on 200/250 A.C. mains, and the other is a Universal resistance model for use on either D.C. or A.C. 200/250-volt mains. But these voltages are, of course, for the lamp only—there is no motor, and the machine is normally cranked by hand. The whole outfit is complete with lamp, flex, transformer or resistance, and one spare spool.

Also available, however, is a complete unit for motorising the projector. This can be fitted in a few moments without alteration to the projector, and it includes the driving belt, pulley wheel and the necessary connection leads. The motor (constant-speed single-phase synchronous type), has been carefully designed to give normal projection at 16 frames per second.

Yet another important accessory is the new Type A.D. projector lamp, which when used with the Ace, will produce 60% more light. As the use of this lamp requires a little more power, a separate transformer to go with it can be purchased at the same time.

Existing transformers can be exchanged for the new model at less than half price.—Pathescope Ltd., North Circular Road, London, N.W.2.

R.C.A. Model PG-201

This 16-m.m. sound projector is designed and manufactured by the Radio Corporation of America. Future distribution here will be handled by the British Company—R.C.A. Photophone Ltd., of 43, Berkeley Square, London, W.1.

We know, of course, that film-gates should open somehow and without too much trouble, but we never went so far as the man who decided that "the gate had better come right off and be done with it!" It can be entirely removed in one second for easy and rapid cleaning, and it goes back just as fast. For threading, however, the gate swings open in the normal manner—and without falling off.

Other features of this remarkable projector are listed below:—

Lamp—Standard 750 or 1,000-watt pre-focus.

Lens—2" F.1.6 "super" bloomed.

Condenser Lens—Large 2-element aspherical type.

Motor—Sturdy, slow-speed, heavy-duty type. No brushes or governors.

Gate—Completely removable by merely lifting it out.

Threading—Very simple, and can be done with one hand.

Take-up—Automatic and with compensation.

Rewind—Automatic, and without changing spools or belts.

Speed—16 and 24 frames per second. Motor speed is constant within 1% even when mains voltage is fluctuating 10%.

Controls—Lamp and motor switches are interlocked but can be used separately. Sound/silent switch. Tilt control, theatrical framing, volume and tone controls. Inputs for microphone or non-sync.

Spool capacity—Up to 2,000 feet.

Amplifier—A powerful four-stage amplifier which utilizes the "inverse feedback" principle. It's specifications are:—

Gain—118 db, photocell input; 118 db mike input.

Input impedance—85,000 ohms (microphone jack).

Power output—20 watts; less than 5% distortion.

Output Level—Plus 35 db. (db.=decibels).

Speaker—10" permanent magnet.

Voice coil impedance—8.0 ohms.

Sensitivity—97 db. at 4 feet with one watt input.

Power requirements—(With 750-watt lamp), 1,000 watts (105-125 v. A.C.).

Cables—Speaker, 50 feet. Power, 15 feet, with moulded connector plugs.

Weight (gross)—Projector-amplifier case, 59 lbs. Speaker case, 29 lbs.

Finish—Medium brown Spanish-grain leatherette.

Altogether, the R.C.A. 201 is a readily portable two-case deluxe equipment. One case contains the speaker, spool-arms and spares, together with the speaker-cable and power-cable. The other case contains the projector-amplifier unit. The front of the projector case is held in place by four heavy clasp-locks, and is completely removable for equipment operation. An automatically-operated spring-device on the carrying-handle prevents the handle from resting over the projection lamphouse.

The speaker-case is designed to operate with the back cover closed, thus protecting the unit from dust and dirt, and, at the same time, eliminating the effects of the acoustical variations that occur when the conventional open-type speaker-case is located near walls, floors and corners of rooms. The built-in acoustically-engineered speaker-unit assures uniform performance under varied operating conditions.

The Victor "Animatophone"

Among the many new features of the Victor is to be found complete protection against film damage. The patented Victor safety film-trip is incorporated at every point where an emergency might arise, and damage to film perforations is entirely prevented by "Duo Flexo" pawls which spring over the film to engage the first holes.

Another Victor innovation is the *offset film-loop*, so designed that the film is allowed to flow naturally to one side of the channel, and so prevent "screen-image weave" (Fig. 36). The user will also appreciate the theatrical framing device.

Instant accessibility for cleaning both aperture-plate and film-channel is provided by the 180 degrees swing-out lens-mount. It is made to open as a gate should, and the operator can plainly see what he is doing when cleaning it.

The discerning will also appreciate the highly efficient cooling-system. A motor-driven fan forces the air in a spiral path around the lamp and between multiple walls of the lamphouse, thus preventing over-heating of the projector-mechanism and allowing the most powerful lamps to be used with perfect safety.

The Victor is equipped for both silent and sound film-speeds, "still" pictures, and for reverse action. The reverse-switch may be used without having to stop the motor first—something that

cannot be done on every projector. There is also a motor-driven rewind, which obviates the usual changing of spools.

Illumination is from a standard 750-watt pre-focussed projection lamp, which can be changed when desired in a matter of seconds. All the elements of the optical-system are precision-made and permanently spaced and aligned. There are no mirrors, and nothing to get out of adjustment. The Victor shutter is designed for minimum light-interruption, and makes possible a clear, flickerless picture of brilliant intensity. A coated 2" F.1.6 projection lens is supplied with the machine as standard.

Another interesting feature is the stationary sound-drum, and two flywheels instead of one are employed before and after the scanning-point to keep the sound-pitch even. The sound-lens, of great focal depth, provides equally sharp response from either monochrome or coloured films.

The mechanical filter is of the flat-spring type, and is unaffected by time, temperature or humidity, and requires no oiling or adjusting.

Light for the sound-optics is provided by a new type exciter-lamp. It is many times more brilliant than the usual type, and is rated for a 100-hour life instead of the customary 50 hours. The result is "cleaner" sound with less background noise, and also a longer photo-cell life, though the latter is already provided for by an improved compensation for mains-voltage variations.

Power output and frequency from the amplifier is adequate for powering four 12"-speakers. The amplifier is ruggedly constructed and built for strength, and the valves ventilated and instantly accessible.

The Victor is designed to work on 110 volts A.C., but as voltages differ so much, the makers have introduced a new step-down transformer as an integral part of the equipment. Its use, of course, being to lower the voltage to a steady 110 for the projector when working on a mains supply of 200 to 250 volts.

Housed in an attractive leatherette carrying-case, is the special 12" permanent-magnet dynamic loud-speaker, efficiently baffled and protected against moisture and other damage. It is equipped with an impedance matching-switch for use with additional speakers up to four in number. A convenient reel-board and rack accommodates the 75' speaker-lead within the speaker-case.

Altogether, the Victor is more than a welcome addition to the

list of post-war models, and it has all the new features expected and hoped for by many teachers and showmen. It is fitted with a minimum of controls and all are well marked, accurate, and positive in action. Starting, stopping and "still" projection are all accomplished by using the same simple clutch-lever, which can also be used to wind the film in order to review a scene on the film.

It is manufactured by the Victor Animatograph Corporation (London), Ltd., 9, Cavendish Square, London, W.1, who will be pleased to give the reader further information.

Appendix

FILM LIBRARIES and EQUIPMENT MANUFACTURERS in Britain have increased in numbers to such an extent that it is not possible to list them all within the confines of this small book and we therefore draw the reader's attention to the Year Books (listed in this Appendix) should he require addresses or similar information.

PUBLICATIONS

- Amateur Cine World:** Price 9d. Monthly. 24, Store Street, London, W.C.1.
- British Kinematography:** 5/- Monthly. The official journal of the British Kinematograph Society. 164, Shaftesbury Avenue, London, W.C.2.
- Business Screen:** Published in U.S.A. Copies at 2/6 from Current Affairs, Ltd., 174, Brompton Road, London, S.W.3.
- Catholic Film News:** 2/- per annum. Monthly. 45, Elm Park Mansions, Park Walk, London, S.W.10.
- The Cinema:** 1/- Weekly. 93-95, Wardour Street, London, W.1.
- Cine-Technician:** 1/-. Two-monthly. The journal of the Association of Cinematograph and Allied Technicians. 2, Soho Square, London, W.1.
- Daily Film Renter:** 3d. 127-133, Wardour Street, London, W.1.
- Documentary Film News:** 1/-. Monthly. The Film Centre, 34, Soho Square, London, W.1.
- Educational Film Bulletin:** 3d. Monthly. The Scottish Educational Film Association, 2, Newton Place, Glasgow.
- Film Forum:** 6d. Quarterly. Federation of Scottish Film Societies, Film House, 6-8, Hill Street, Edinburgh, 2.
- Film Industry:** 1/-. Monthly. 58, Wardour Street, London, W.1.
- Film Quarterly:** 2/-. 100, Old Square, Lincoln's Inn, London, W.C.2.
- Film Sponsor:** 1/6. Monthly. 19, Charing Cross Road, London, W.C.2.
- Film User, The:** 1/-. Monthly. 174, Brompton Road, London, S.W.3.
- Ideal Kinema:** 1/- Monthly. Supplement to Kinematograph Weekly, and published separately. Address below.
- Kinematograph Weekly:** 1/6. 93, Long Acre, London, W.C.2.
- Look and Listen:** 1/6. Monthly. 24, Bride Lane, Fleet Street, London, E.C.4.
- Mini-Cinema:** 1/-. Monthly. 93-95, Wardour Street, London, W.1.
- Monthly Film Bulletin:** 1/6. The British Film Institute, 164, Shaftesbury Avenue, London, W.C.2.
- Scannan (Film):** 3d. Monthly. Portlaoighise Film Society, Portlaoighise, Eire.

See and Hear: Published in U.S.A. Copies at 2/6, from "Film User" (above).
Sight and Sound: 2/6. Monthly. The British Film Institute. Above.
Sub-Standard Film: 6d. Monthly. Supplement to *Kine Weekly*. Above.

SELECTIONS FROM THE LIST OF B.F.I. PUBLICATIONS

Appraising Educational Films. (With specimen Appraisal Form.) 6d.
Choosing a School Projector. 1/-.
The Content of Educational Films. 6d.
Copyright in Film Slides and Film-Strips. Gratis.
The Design and Construction of School-made Diascopes and Episcopes. 9d.
Design of Projectors for Educational Purposes. 6d.
Film Appreciation and Visual Education. 2/6.
Film in the Club. 6d.
Teaching with School Projectors. 1/6.
Using a School Projector. 1/6.
Visual Education. 6d.

YEAR BOOKS

Film User Year Book: 10/6. Current Affairs Ltd., 174 Brompton Road, London, S.W.3.
Informational Film and Television Year Book: 10/6. Albyn Press, 42, Frederick Street, Edinburgh, 2.
Kinematograph Year Book: 20/-. London Kinematograph Publications, Ltd., 93, Long Acre, London, W.C.2.
Visual Aid Year Book: 3/6. Daily Mail School-Aid Department, New Carmelite House, London, E.C.4.

SOME FILM ORGANISATIONS

Of special interest to projectionists.

The British Film Institute, 164, Shaftesbury Avenue, London, W.C.2.

The B.F.I. exists to encourage the development of the art of the film, to promote its use as a record of contemporary life and manners, and to foster public appreciation and study of it.

From small beginnings its work has extended over an ever-widening field of activity in which the stewardship of the National Film Library the development of the Film Society Movement, and the cultivation of critical film appreciation stand prominent. The Institute was also appointed a constituent body of the Festival of Britain, 1951, with responsibility for the film side.

Work of such national importance naturally demands the support of all who are interested in the film as an art form, as a social influence, or as an educational force. But the Institute does not only make demands—it offers considerable benefits to its members. Here are a few of them:

1. The monthly magazine *Sight and Sound*, the *Monthly Film Bulletin*, and from time to time other miscellaneous publications, are distributed gratis to members.

2. **FILM HIRE SERVICE.** Many of the titles held in the National Film Library are available from the Distribution Section of the B.F.I. These films can be hired by members at a reduced rate.

3. **PRIVATE CINEMA THEATRE.** The Institute's own private theatre at Great Russell Street, W.C.1. is available for hire by members in the evening. It is equipped with both 35-mm. and 16-mm. projectors and has seating accommodation for 10 people.

4. **INFORMATION CENTRE.** The Centre, which adjoins the library, answers enquiries personally, by telephone and by letter. It deals with several thousand queries every year, and from its reference library it is possible to obtain particulars of every film recorded.

5. **TELEVISION VIEWING ROOM.** The Institute's private television viewing-room may be booked by certain members in the evening, and it has comfortable seating accommodation for eight people.

6. **THE BOOK LIBRARY** is one of the largest of its kind in the world. It has over 4,000 books dealing with every aspect of the cinema, from every country. It is also well stocked with all current film periodicals, and provides a postal lending-service for members. The reference and reading-room may also be used for browsing or studying.

Besides the book library, there is also a Stills Library and Display Room, etc., and from time to time a Repertory Season of Classical Films . . . All of which makes membership of the B.F.I. a rather attractive proposition.

The British Kinematograph Society, 164, Shaftesbury Avenue, London, W.C.2.

The B.K.S. is the 'learned body' of the British film industry, and is of the highest possible standing. Persons engaged in the kinematograph or allied or contributory industries are eligible to join the Society.

The objects of the Society are many, but all are in some way to do with kinematograph technicalities. The first and most important object is as follows:

To encourage and further the scientific and technical aspects of British kinematography; to encourage the study of kinematography in all its branches, and of its allied and contributory arts and sciences.

Membership is composed of Students, Associates, Members, Hon. Members, Fellows and Hon. Fellows, the last named being entitled to the use of the following initials after their names—M.B.K.S., F.B.K.S. (Associates and Students do not rank as Corporate Members and are not allowed to use the qualifying initials). The Society has three Divisions—Theatre, 16-mm. Film, and Film Production Division, besides provincial sections at Leeds, Manchester and Newcastle-on-Tyne.

Meetings of the Society and Divisions are held at frequent intervals, at which papers are read and demonstrations of new equipment are given.

The 16-mm. Film Division is particularly active and growing rapidly in conformity with the wider use now being made of narrow-gauge films. Members of this Division (as with the others), are kept abreast of developments by lectures given by the leading technicians of the day, and at demonstrations they are afforded the opportunity not only to examine new equipment, but also to question the manufacturers' representatives regarding design and performance.

The Society also publishes the monthly magazine 'British Kinematography', which reprints papers read to the Society, gives interesting

technical extracts from foreign contemporary journals, and in every way ensures that the readers are kept informed of all modern developments. The journal is free to members, and obtainable by others at an annual subscription of £2 17s. 6d. post free.

The B.K.S. also arranges courses of instruction, maintains a book library and information centre, and has a large number of specialised committees always in active pursuit of progress. Co-operation is maintained with all other interested societies in Britain, plus the Society of Motion Picture and Television Engineers (U.S.A.), La Association Française des Ingenieurs et Techniciens du Cinéma, and similar organisations throughout the world.

Readers gainfully occupied in any branch of cinematography are invited to apply for membership.

Royal Photographic Society, Kinematograph Section, 16, Princes Gate, London, S.W.7.

The Kinematograph Section of the R.P.S. offers its members frequent lectures on all the many aspects of production and projection, besides arranging demonstrations of new equipment. The meetings are often held in conjunction with other societies when the subject warrants it, and members are thus enabled to meet specialists in many branches of the industry.

The talks and lectures are often illustrated by films and slides, and modern projection equipment is always on hand for suitable occasions. Members who make their own films have the additional advantage of the specialist panel set up by the society, which offers skilled criticism and professional advice on the latest techniques.

The Society holds meetings for nine months out of the year for the various sections. These are the Pictorial Group, Colour Group, Miniature Camera Group, Scientific and Technical Group, the Medical Group, and last but not least, the Kinematograph Section. Membership of the Society is divided into six classes—Ordinary, Fellows, Associates, Honorary Fellows, Honorary Members, and for those under 25—Junior Members. Associates and Fellows are entitled to the use of the initials A.R.P.S. and F.R.P.S.

British Standards Institution, 24, Victoria-st., London, S.W.1.

The B.S.I. is responsible for co-ordinating the work of all bodies concerned with standardisation in technical and scientific developments, with simplification of design, and with all aspects of safety, size and quality. The Institution was founded in 1901 and quickly became recognised for the value of its contribution to progress, being subsequently Incorporated by Royal Charter. Almost all trade organisations are now represented on the various B.S.I. committees, and a dozen or more organisations representing the whole of the film industry are in continual contact through their representatives.

The B.K.S., for instance, has representatives on the Kinematograph Industry Committee, which deals with such items as Standard release prints, projection equipment, screen brightness, projection lenses, and terminology, etc. Some of the more important Standards for narrow-gauge film users are as follows:

B.S. 850:1939—Definition of Cinematograph 'Safety' Film.

B.S. 930:1940—Method of Carrying out a Field Test for Light Output of Sub-standard Cinematograph Projectors.

B.S. 1488:1948—Test Film for 16-mm. Cinematograph Projectors.

B.S. 1522:1949—Schedule of Projector Lamps.

B.S. 1585:1949—16-mm Cinematograph Sound-on-film Release Prints.

These are extracted from the Sectional List of British Standards on Cinematography and Photography—the list is free, and each Standard quoted above is priced at 2/- post free.

Sectional lists are available for every industry, and a complete list of all British Standards, including abstracts, will be found in the B.S.I. Year Book. The Institution also publishes the Standards Review (2/-) which reviews all new standards as they are issued.

The Mobile and Small Kinema Association, Queen's House, Leicester Square, London, W.C.2.

This is a trade association for professional 16-mm. exhibitors, and is actively concerned with the safeguarding of their interests. Full details of membership, etc., will be gladly sent to all who make application to the Secretary.

PRACTICAL DEFINITIONS

ABERRATION, Chromatic: In a lens, the breaking up of pure light into its component colours.

ABERRATION, Spherical: A defect in the image formed by a lens or mirror with spherical surfaces, the image being, in most cases, only an approximation to the ideal figure for the surfaces.

A.C.: An abbreviation for Alternating Current. The electricity flows first in one direction in a circuit, and then in the other, each complete alternation being known as a cycle, and occurring, usually, at the rate of 50 per second.

ACOUSTICS: The study or science of sound. The acoustic property of a material is the amount of sound it absorbs or reflects. Acoustic waves are merely waves of sound, which normally travel at the rate of between 1,090' and 1,100' per second in air.

ALTERNATOR: The generator which produces alternating current.

AMMETER: An abbreviation of Ampere Meter, used for measuring electric current in amperes.

AMPERE HOUR: The use of one ampere for one hour. Amperage is the rate of flow, and denotes the amount of electricity which may pass a given point each second. One ampere hour equals 3,600 coulombs.

AMPLIFIER: An apparatus used to increase sound volume in an electrical sound-system.

AMPLIFICATION FACTOR: The "M" value of a thermionic valve. This denotes the maximum voltage amplification that a valve can produce.

ANODE: The plate of a thermionic valve. (See Kathode.)

ANODE TERMINAL: This is the positive end or part of any electrical device or apparatus. The cathode is the negative or opposite part.

APERTURE: The opening in the projector aperture plate through which the film receives the light for projection.

ARMATURE: This is (usually) the rotating part of an electrical motor, and in which the electrical energy is generated or transmitted as a controlled force.

AXIS, OPTICAL: The exact centre line passing through a beam of light or one or more lenses of an optical system.

- BACKLASH, Acoustic:** A direct and distinct echo from a nearby smooth surface, and often noticeable when a loud-speaker is placed in front of a hard smooth wall.
- BACKLASH, Mechanical:** Another name for lost motion, especially in relation to the projector shutter blades.
- BALANCE RESISTANCE:** A resistance made to take the electrical load from a projector lamp when the latter is switched off. The use of a balance resistance in a projector without automatic speed-control results in the motor continuing its normal running speed, which in some cases would be considerably and suddenly increased were the voltage used by the lamp suddenly diverted to the motor. The balance resistance is also a necessity with certain generators.
- BALLAST LAMP:** An expensive and incorrect method of reducing current to the amount required for a specific purpose. A transformer or resistance should be used instead. The ballast lamp, usually of high wattage, is connected in series with the equipment.
- BINDING POST:** An American term used to denote a terminal.
- BLATTNERPHONE:** A system for recording sound by variable magnetism upon a length of steel tape or wire.
- BLOPING PATCH:** The black patch formed after painting over the sound track at the point of a newly-made join. Failure to carry out this necessary part of splicing results in a noisy "plop" each time the join passes through the sound-head.
- BLOWING A LAMP OR VALVE:** The actual burning of the filaments, due to age, excess voltage or perhaps carelessness.
- BLOWING POINT:** The point at which a certain amperage will cause the weakest part of a circuit to melt, such as a fuse wire or the filaments of a lamp.
- B.O.T. UNIT:** Board of Trade Unit of electrical energy equal to one Kilowatt-hour. (Kilowatt is 1,000 watts.)
- B.Th.U.:** British thermal unit. The amount of heat required to raise the temperature of 1 lb. of water by 1 degree F.
- BY-PASS CONDENSER:** In an amplifier, a condenser used to separate A.C. and D.C. in a circuit. Usually of the fixed capacity type, and so arranged that it "by-passes" certain frequencies which would otherwise pass through the circuit across which it is placed.
- CANDLE POWER:** A unit of illumination, based upon the amount of light produced by a single standard candle, and measured at a distance of one foot from the centre of the flame. Illumination is thus measured in terms of foot candles.
- CAPACITANCE OR CAPACITY:** In a condenser the amount or measure of an electrical charge it is capable of holding. Capacity is measured, in relation to the initial voltage supplied, by microfarads.
- CAPACITY:** In a fuse or circuit, the amount of current it is designed to carry.
- CELLULOID:** The hard transparent base of standard film, highly inflammable.
- CHECK SPEAKER:** The monitor speaker, used in the projection room for the benefit of operators, enabling them to judge the sound within the auditorium.
- CHANGE-OVER:** Changing from one projector to another during a show.

- CHANGE-OVER CUE:** An audible or visible indication that the reel is within a certain number of feet from the end, or, that a film-strip should be advanced.
- CIRCUIT BREAKER:** An automatic switch which opens a circuit under abnormal or dangerous conditions, such as occur in over-loading, etc.
- COLLECTOR LENS:** In an episcopes, a wide angle projection lens used to catch as much of the reflected light as possible. In a cine projector, the condenser lens nearest the light source.
- COOLING PLATE:** A metal shield so arranged to catch the heat and light rays which do not penetrate the aperture, and to prevent the aperture plate and other parts of the gate from overheating.
- CONDUCTOR:** Any material used to carry electrical current and having a comparatively low resistance. A non-conductor is any material which prevents the flow of current or offers high resistance to it.
- CONTINUOUS CURRENT:** This is another name for Direct Current.
- CONDUIT:** The metal casing over one or more insulated wires or cables.
- CONVERTER, ROTARY:** A machine used for modifying the properties of an electric current, especially used for changing D.C. to A.C.
- COULOMB:** An electrical unit for volume, equal to one ampere flowing for one second. 3,600 coulombs equal one kilowatt-hour.
- CUT-OFF:** The frequency limits of an electrical transmitting or reproducing apparatus.
- DAMPING:** In the smoothing system, a device consisting (usually) of one or more weighted or sprung idler-rollers which press upon the film as it passes through the soundhead. Damping prevents flapping or "belt action" of the moving film.
- DAMPING, ELECTRICAL:** The speed at which a succession of oscillations are faded to nil.
- D.C.:** Direct Current. A current made to flow in one direction in a circuit.
- DECIBEL:** A unit of transmission of sound, generally used to indicate gain or loss.
- DIFFUSION:** The "splaying" of light rays, resulting in a picture with poor definition. The opposite to focus.
- DIMMER:** An adjustable resistance or rheostat used to control current supplying one or more lamps. Stage lighting is usually so controlled.
- DIODE:** A thermionic valve having only two electrodes. One is the cathode or filament, and the other is the anode, or plate.
- DISTORTION:** A slight alteration in wave form which occurs between recorded sound and reproduced sound. An amplifier may be said to have an output of 10 watts with up to 5% distortion. The distortion from a 16-mm. amplifier should not exceed this figure.
- DOWSER:** A device used to cut the light from a projector lamp. The metal plate which moves into position between the aperture and the condenser lens, and is controlled by means of a manual switch. A manual switch is one which completes a movement or actuates a part without the aid of electricity.
- DRAPING:** Material with sound-absorbing properties, used to cover walls, etc., in order to control echo. Also used for decorative purposes.
- DRAPES:** A black material used to cover portions of the screen's surface not covered by the picture.

EARTH LEAD: The wire which connects any electrical apparatus with the earth, and used as a safety precaution in the event of a short circuit. The largest pin in a 3-pin connector is for the wire which will convey to earth the escaping current. The earth lead should be one with a very low resistance. There is no danger from a loose connection if the escaping current is enabled to flow directly to earth, providing, of course, that the projectionist is not standing in a pool of water and making himself a better earth than the one connected. Projectors using a 2-core mains cable may be connected by a copper (earth) wire to a convenient water pipe, care being taken to first remove the paint—the paint may act as insulation. (See Ground).

ECHO: Reflected sound. A continuous echo is known as reverberation. The sound is reflected from different surfaces according to the surface structure. A hard smooth surface will produce a distinct echo with a certain amount of strength, whilst a soft porous surface will break up and scatter the sound so that it cannot be heard as an echo.

EFFICIENCY: The amount of energy supplied to a machine in relation to the amount used for actual performance. A highly efficient electrical motor is one which usefully employs all the current supplied to it.

ELECTRIC CURRENT: An artificially produced or natural flow of electrons and ions carrying negative and positive charges respectively. The actual nature of electricity is unknown.

ELECTROLYTIC CONDENSER: A small condenser having a relatively large capacity.

E.M.F.: Electromotive Force. The pressure of an electric current, measured in volts.

EMULSION: A light-sensitive substance applied to photographic film, in which the photographic print is impressed by means of light-action.

EXCITER LAMP: A small voltage single "spot" filament lamp which provides light for the photo-cell in reproduction of sound. Exciter rays are for the same purpose but are directed from the projector lamp.

FADER: In projection, the potentiometer controlling sound-volume.

FADING IN: Gradual lighting of the screen, usually by means of a slide-resistance connected to the lamp circuit.

FILAMENTS: In a lamp or valve, the fine strands of wire which heat or light up. The wires which produce heat within an electric iron or fire are known as elements.

FUSE: The fuse is really an electrical safety valve. Usually in the form of a single strand of wire, it will melt and thus break an electrical circuit should the current exceed a certain value. The fuse wire for domestic lighting is usually rated at 5-amps., insufficient for many 16-m.m. projectors, especially those using resistances.

GENERATOR: The machine which converts mechanical energy into electrical energy and produces a *flow* of electricity. Electricity cannot be "manufactured."

GRAPHITE GREASE: Soft graphite is used in the manufacture of high-temperature grease, and is often used for lubrication in projector mechanisms.

GROUND: American term for "earth."

H.F.: High frequency. Frequencies above those of 14,000 cycles per second, and sometimes known as the supersonic. Low frequencies are those below this figure—the audio or sound frequencies heard by man.

INSULATION: A non-conductive material used for the protection of an electrical circuit or used to separate circuits.

INSULATION TAPE: A specially made non-conductive and adhesive tape used for covering cable joins, etc. Ordinary adhesive tape should not be used for insulation purposes.

INTERMITTENT MOVEMENT: The mechanism which actuates the movements of the intermittent sprocket or claws in a cine projector.

INCHING KNOB: A knob which allows the operator to turn over the motor, or the motor and mechanism, by hand. Chiefly used for examining the threading (lacing) of the film.

JACK PLUG: A telephone switchboard-type of plug-connector, mostly used for the gram and microphone inputs in an amplifier.

JUNCTION BOX: A joint in a metal conduit. A 4-way junction box is one which connects 4 conduits. They are usually so designed that they are easily opened for inspection or servicing, etc., of the wires they enclose and protect.

KATHODE OR CATHODE: Usually the filament of a thermionic valve, and from which the electrons are emitted when heated by the passage of an electric current. A cathode may also describe the negative pole of an electric current in circuit.

KNIFE SWITCH: A switch opening and closing after the manner of the blade of a pocket knife. Contact is made when the blade is closed.

LEAD: A cable or wire used for a specific purpose, such as the speaker or mains lead. Pronounced as "lead."

LEADER: A length of white (or black) opaque film attached to the beginning of a spool of film, and long enough to be used for threading the film in the projector. Saves the actual start of the film from damage should a fault occur on starting the projector.

LENS MOUNT: The casing or that part of a machine into which the lens is fitted.

MAGAZINE: The projector spool compartments—only used on standard (35-m.m.) projectors and one or two 16-m.m. machines of French design. The film-can on a strip-projector may also be termed a magazine.

MICROPHONIC: A term denoting that a valve or lamp is faulty. The filaments or casing may excessively vibrate, perhaps "in sympathy" with other mechanical vibrations, and the valve then transmits the new and unwanted frequency through the rest of the amplifier to the speaker. The fault is heard as a prolonged whistling or ringing tone, and may sometimes be cured by shielding the valve from the vibrations from the other valves or by binding the glass with insulation tape. A microphonic exciter lamp should be changed as soon as possible.

NEGATIVE FILM: The exposed film after developing, showing the lights and shadows reversed from the normal.

NON-SYNC.: Non-synchronisation. Any apparatus providing sound not synchronised with the film, such as the microphone and the electric gramophone. The latter is usually known as the non-sync.

OHM: An electrical unit for measuring resistance.

OPTICS: The elements of an optical system, such as the lenses, prisms, and glass rods.

OVER-SHOOTING: A fault in projection, in which the picture-frame on the film tends to over-shoot the frame of the aperture. It is usually corrected by the operator using the Framer, or Framing Knob.

OVERLOADING: Using an electrical circuit for more current than it is designed to carry. Overloading will cause the weakest part of the circuit to over-heat and eventually burn or melt. This part should be the fuse.

PARALLEL WIRING: If two or more lamps are each connected across a circuit they are said to be in parallel. "Across a circuit" implies that both wires are connected to each lamp in turn.

PERFORATIONS: The holes in cine film, which engage with the teeth of the projector sprocket-wheels.

PHOTO-ELECTRIC CELL: A device which reacts electrically to light directed upon it, and is usually shaped like a small valve. It is used for many other purposes besides sound recording and reproduction. It is used to open and close doors, check trains in and out of stations, operate burglar alarms, count people, and switch the street lamps on and off.

PHOTOMETER: A device for measuring the intensity of light.

PICK-UP: The needle-holder and arm of an electric gramophone, which converts the impulses from the needle into electrical impulses.

PITCH: The "tone" in music, i.e., if the lower audio-frequencies dominate the higher frequencies, the tone will be low pitched. The tone is usually controlled by a handy knob on the amplifier, and which should be used by the operator to keep the pitch even, or in accord with the acoustics of the hall.

POTENTIAL: A specific pressure or voltage of an electric current.

POTENTIOMETER: The device actuated by the volume control. It consists of a number of tappings of varying potential, and the volume is thus controlled by varying the amount of voltage to the output valves.

PROJECTIONIST: A professional "operator." One who makes the projection of moving pictures his living.

POSITIVE PRINT: A copy taken from the negative film: the film used in projection. Also known as a release print. A reversal print is the original film which has been developed in such a way as to give a print directly.

RAIN: In projection, the vertical black lines which appear on the screen, and which are caused by scratches on the film. The scratches are quickly filled by dirt, and the resultant black lines are magnified with the rest of the picture.

RECTIFIER: Any apparatus or valve used to convert A.C. to D.C.

REEL: A 400' length of 16-m.m. film. In America, the spool on which the film is wound.

REFLECTOR: A highly polished disc with a concave surface. It is positioned within the lamphouse to collect and converge the rays of light from the lamp towards the aperture. The surface of a reflector may be either aspherical, parabolic or elliptical—something to remember when ordering replacements.

REFRACTION: A change in direction of light-rays after passing through a lens or other medium. Sound-waves may also be refracted.

RENTER: A trade term for film distributor.

RESISTANCE: The opposition offered to an electric current when passing through a circuit: an apparatus designed to resist current, and used in order to lower the voltage. A resistance may be either "fixed" or "variable," and can generally be used on both A.C. and D.C. The variable resistance is usually operated by means of a slide or one or more tapping screws, and is supplied for use with many 16 mm. projectors. A rheostat is the same thing to the Americans.

RESISTOR: In an amplifier, a small fixed resistance, used to reduce the low tension voltage supplying the valves.

SCANNING: The forward movement of the sound track in front of the exciter light, which is said to "scan" the former.

SCANNING DISC: A term (wrongly) used to indicate some part of the sound optical system. The scanning disc is chiefly used in television and radio or cable picture transmission.

SERIES WIRING: If two or more lamps are connected to each other on the same wire or side of a circuit, they are said to be wired in series. The failure of one lamp will therefore result in them all going out at the same time. A number of 16-m.m. sound projectors have their valves wired in series.

SINGLE PHASE: An alternating (A.C.) current of one voltage flowing through one pair of wires only.

SHUTTER: One or more blades attached to a revolving centre piece, and positioned between the light source and the aperture. The largest blade is known as the master blade, and is mechanically timed to shut off the light each time the film moves in the gate, or film channel. The other blades, if any, assist the even alternations of light necessary for clear and flickerless projection.

SHUTTER GHOST: The result of displacement of the shutter upon its spindle, and shown on the screen as a whitish blur or reflection. It is most distinct when looking at the titles, and may appear either above or below the wording—described as a top or bottom ghost respectively. (Can be "laid" with a screwdriver.)

SOUNDHEAD: That part of a projector containing the sound optics and smoothing system.

SOUND TRACK: A narrow track on one side of the film on which the sound is printed.

SOUND-SPEED: The speed of sound-film through the projector. 16-m.m. sound-film should be projected at the rate of 24 frames per second, and silent film at 16 f.p.s.

SPLICING: The act of joining two films together. The Splicer is the device used to make such joins.

STANDARD FILM: Films of certain width and other dimensions established by the Society of Motion Picture Engineers. The Society's standards are generally accepted throughout the world. There are two sizes of Standard film—16-m.m. and 35-m.m. Other films with a smaller gauge below 35-m.m. are known as Sub-standard, a term generally used (incorrectly) when referring to 16-m.m.

SYNCHRONISATION: The correct reproduction of relative sound for the picture. Sound is printed 26 frames ahead of the picture-frame, and the length of film between aperture and scanning point must therefore remain a constant 26 frames for perfect reproduction. A greater or lesser length (often caused by the bottom film-loop being the wrong size) will put the sound "out of sync."

- TAKE-UP:** The device or mechanism used to take up the film onto a spool as the film leaves the projector.
- THROW:** The length of the projected light-beam between the lens and the centre of the screen.
- TRAILER:** A short length of opaque film attached to the end of a part or spool of film. The National Anthem forms the "Queen Trailer."
- TRANSFORMER:** A device used for changing the voltage of an alternating current. It may be either a step-up transformer or a step-down one, and is usually fitted with a tapping switch or screw for regulating the output. Transformers must not be used on D.C.
- VARIABLE CONDENSER:** A condenser so designed that its capacity may be quickly altered.
- VOLT:** The electrical unit of pressure, or electromotive force.
- WATT:** The practical unit of electrical power, and equal to one joule per second. A joule is the unit of energy. The output from an amplifier is measured in wattage.
- WOW:** A slight alteration in sound-speed as the film passes through the soundhead will cause the sound to go sharp or flat. The noise then heard from the speaker is termed a "wow." It may easily be caused by incorrect threading or by a fault in the smoothing system. Should it be caused by the film riding off a sprocket-wheel, the motor must be switched off at once and the film re-threaded.

Index

-
- A.C. and D.C. 35, 57, 58, 95, 96, 131
 Air cooling 32
 " intake 32
 Alcoholic drinks, regulations 138
 Alternator 57
 Amplification 45
 Amplifiers 43, 43
 " cleaning 122
 Appendix 171
 Arc lamps 110, 111
 " projection 110, 111, 112
 " tungsten 148
 Associations & Societies 172, 173, 174, 175
 Attendants 136
 Audience, regulations 136
 Automatic speed governor 127

 Bakelite connectors 54
 Beaded screens 75, 76
 Belts, wire 33, 119, 122, 129
 Bi-film rewinders 53
 Blank spacing 61
 Blooming 69
 Brushes, motor 121, 126
 Brush, gate cleaning 117
 Buzz track 71

 Cables, power, 53, 54, 55
 Carbon arcs 26, 110, 111, 112
 Carbon tetrachloride 60, 117
 Cement, formula for 65
 Censor's certificate 103
 Change-over cues 106
 " " making 108
 " " units 108, 109
 Children in audiences 136, 137
 Chrome, cleaning 117
 Cinemas, 16mm static 17
 Cinematographers 15
 Claw movement 30
 Cleaning films 60
 Coloured films and slides 112, 113
 Commutator, cleaning 118
 Compensation, automatic 35
 Condensers 25
 Condensing system 25
 Connections, electrical 49, 50, 53, 54, 55, 56, 98
 Cooling systems 32
 Constant-frequency test films 72
 Containers, film 58
 Controls 36, 37
 Continuous projection 110
 Conversions, sound 46
 Converter, rotary 35, 57, 96
 Curtain unit 151
 Cycle films 70

 Damage, film test 70
 " " repairing 73
 Damping-smoothing 40, 41
 D.C., Equipment for 57, 58
 " motors 35
 Decimittent movement 30
 Definitions, listed 175
 Diascopic projection 26
 Dispatching equipment 123
 Distributors, film 15
 Drapes 91
 Dual projection 22, 105, 106, 107, 108, 109
 " projectors 22

 Earthing projector 43, 49, 50
 Educational Foundation for Visual Aids 143
 " film requirements 139, 140

 Emulsion, film 113, 117
 Entertainments Tax 133, 134
 Equipment, buying 18
 " choosing 18
 " care of 88, 115, 116, 117, 118, 119, 120, 121, 122
 " installing 20, 95
 " new, information on 21, 22
 " secondary requirements 19
 " setting up 90, 91, 92, 93, 94, 95, 97
 " storing 89, 114
 Excitation 40

- Exhibiting 90
- Exciter lamp 38, 39, 40, 121, 131
- " rays 38
- Exits 136
- Exhibitors 15
- Fault finding, mechanical 124, 125, 126, 127, 128, 129, 130, 131
- " sound 131, 132
- Feed spool 24, 33, 130, 131
- " braking 33, 34
- " sprocket 24, 131
- Film booking agencies 22
- " channel 28, 29
- " hire costs 18, 22
- " interpunched 67
- " loops 24, 30, 32, 33, 124, 125, 128
- " optical systems 25
- " speed 24
- " stock 62, 63
- " trade journals 22
- " track 24
- Films, cleaning 60
- " damaged 69
- " examining 69
- " protection of 63, 64, 65, 85, 86
- Fire regulations 136
- Flex connector 53
- " repairing 54
- Flicker 36, 129
- " arc 148
- Focussing 105
- Foot candles 81
- Framing (racking), 28, 29, 104, 105
- Fuse 49
- " box 56
- Fuses 42, 56
- Gate 28, 29
- " brush 117
- " pressure 62, 63
- " temperature 32
- Gangways, 92, 136
- Geneva movement 31, 32
- Gliding frequency test-films 72
- Gramophone 42
- " speeds 47
- Grain in film 63
- Greasing 116, 118, 119
- Green prints 62
- Governor, speed 127
- Heat, excessive 43
- " filters 33
- Home Office Regulations 134, 135, 136, 137
- Idler rollers 119
- Inching knob, 33, 107
- Insulation tape 54
- Intermittent "heat" 30
- " mechanism 24, 28, 29
- " movement 30
- " sprocket 30
- Jackplug 50
- Joins, film 53
- Lacing (spreading) 107
- Lamberts 81
- Lamp life 27, 113, 128
- Lamps, blackening of 27
- " blistering 27
- " changing 27
- " filament 26, 27
- " low voltage 27
- " metal capped 26
- " prefocussed 26
- Leaders, film 61
- " synchronising 62
- Length of throw 20
- Lengths of throw, chart 79
- Lens, Projector 28
- Lenses, buying 20
- " bloomed 20, 28
- " cleaning 117, 118, 120, 121
- " danger from heat 25
- " testing 70
- Libraries, film 65, 67, 68
- Light beam 28
- Lighting circuits 49
- " safety 136
- Loop films 70, 150
- Loud-speakers 44, 45, 92, 122
- " setting up 92
- " repairing connections to 56
- Lumens 81
- Magnetic recorders and reproducers 149
- Maltese cross movement 31
- Mercury arc 148
- Metal surfaces, cleaning 117
- Meters, light 81, 82
- Microphones 50, 51, 52
- Ministry of Education 143
- Mobile operator 93
- Mood music 46, 47

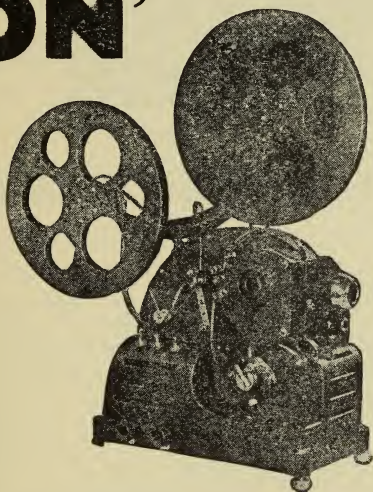
- Monitor speakers 109, 110
- Motors, care of 118, 119, 121
- „ parts powered by 35
- Mutiliation of films 61, 67
- National Committee for Visual Aids in Education 142
- Needles, non-sync. 50
- Non-sync. (electric gramophone) 42, 50
- Octomotive movement 31
- Oiling 115, 116
- Oil-tight joints 30
- Operator's instructions 30, 42, 113, 114
- Optical systems 24, 25
- Overloading 49
- Parallel wiring 43, 44
- Perforated screens 77, 78
- Perforations, film 21
- Performing Rights Society 137
- Persistence of vision 16
- Photo-electric cell 38, 39, 40, 42
- Photometer 81
- Picture cue 107
- „ examining 104
- Pilot light 36
- Power-point 49
- Pre-amplifier 40
- Pre-stage valve 40
- Producers 15
- Programme, making up 61
- Projection, dual 22, 105, 106, 107, 108
 - „ continuous 110
 - „ rear 99
 - „ tips on 87
- Projector controls 36
 - „ exchanges 20
 - „ speeds 36
 - „ „ on starting 107
- Projectors, AC/DC 20
 - „ dual 22
 - „ motion picture 15, 151 to 169
 - „ 9.5 mm sound 21
 - „ still 15
- Prosceniums 149, 150, 151
- Publications 171, 172
- Pulleys 34
- Queen Trailer 69
- Quota Act 134
- Racking 104, 105
- Rear projection 99, 100, 101
- Reel (or part) definition 62
- Reflectors 26, 27
 - „ adjusting 27
- Repairing films 73
- Resistances 21, 48
- Reverse projection 35
 - „ for rewinding 35
- Rewinders 52, 53
- Rollers 41, 119
- Roadshowmen 15
- Rotary convertor 21, 35, 57, 96
- Routine for operator 101
- Runners, gate 29
- Scanning, 24, 38, 39, 71
- Screens, beaded 21
 - „ choosing 20, 21, 78, 80
 - „ characteristics of 75, 76, 77, 78, 80
 - „ setting up 91, 97
 - „ silver 75
 - „ translucent 76, 77, 99, 100
- Screws and rollers 119, 122
- Series wiring 43, 44
- Servicing 115 to 122
- Shocks, unwanted 49, 50
- Shoe, intermittent 30
- Shutter "ghost" 28, 130
- Shutters, 28, 29, 130
- Side rails, gate 29
- Silent speed 41, 45
- Slides 143, 144
- Smoothing system 40, 41
- Snake-track test films 73
- Sound 45
- Sound in auditorium 110
 - „ conversions 19, 20
 - „ cue 107
 - „ faults 131, 132
 - „ frequencies 44, 45
 - „ films 21, 28
 - „ head 24, 39, 41
 - „ magnetic 22
 - „ optical system 25, 38, 39
 - „ speed 41
 - „ tape 149
 - „ track types 38
 - „ „ aligning 71 72
 - „ waves 38
- Speed of projectors 36, 41 127
- Splicers 65, 66, 67
- Splicing films 68, 69, 84
- Spool arms 19
- Spools 58, 62, 64
- Spot filament 38, 40

- Sprocket-wheels 21, 64, 119, 120
 - „ intermittent 30
- Standard films and equipment 17
- Stands, projector 59
- Still-picture device 33
- Stylus, sapphire 50
- Substandard, definition of 16, 17
- Sunday shows 137
- Synchronising discs 46, 47
 - „ leaders 107
- Systems, projector 24, 25
- Take-up, clutch 34
 - „ compensation 34, 35
 - „ drive types 34, 35, 103, 104
 - „ faults 129, 130
 - „ head 34
 - „ spool 24
- Tapping control 49, 112
- Teacher technique 145, 146
- Test films 70, 71, 72, 73
- Testing screen brightness 81, 82
- Tilting projector 104
- Trade press 20
- Trailer, film 61
- Transformer 20, 21, 48, 49, 112
- Translucent screens 76, 77, 99, 100
- Ultra-violet light 148
- UNESCO, report by 18
- Unequal sound 72, 73
- Valves 43, 45, 132
- Voltage 42, 93, 95
- Volume, low 132
- Wattage 42
- Waxing films 63
- Wire belts 119
- Wiring charts 43
 - „ in series 43
 - „ „ parallel 43
- Year Books 172

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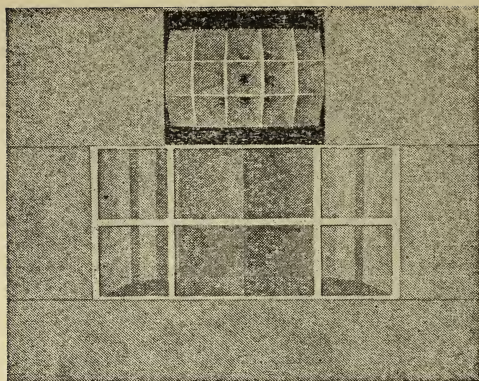
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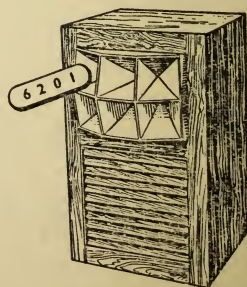
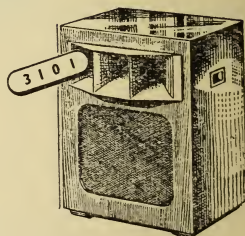
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